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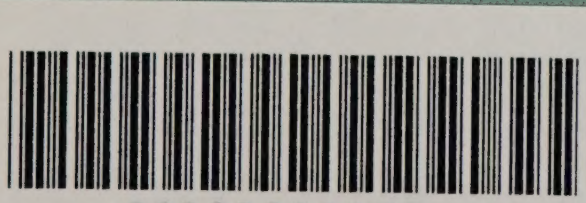
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THE

SCIENCE AND PRACTICE

OF

MEDICINE.

BY

WILLIAM AITKEN, M.D., EDIN.,

PROFESSOR OF PATHOLOGY IN THE ARMY MEDICAL SCHOOL.

IN TWO VOLUMES.

WITH A STEEL PLATE, A MAP, AND ONE HUNDRED AND THIRTY WOOD-CUTS.

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ERRATUM.

Page 800, fourteenth line from top, for "*sulphate*," read "*sulphite*."

THE

SCIENCE AND PRACTICE OF MEDICINE.

PART III.—*CONTINUED.*

CLASS II.

CONSTITUTIONAL DISEASES.

CHAPTER I.

GENERAL REMARKS ON THE PATHOLOGY OF CONSTITUTIONAL DISEASES.

While the General diseases which have been named Zymotic become developed in the human body under the direct influence of agents acting from *without*, the Constitutional diseases, by contrast, may be said to become developed under the influence of agents generated *within* the body itself, and acting through the continuous exercise of its functions. The original organization of the human body may be of such a kind that the continued and prolonged exercise of its functions, in place of preserving the system in a healthy state, ultimately brings about diseases of various kinds in the daily course of development and growth, which (from this mode of origin and development) have received the name of Constitutional Diseases. All of them are eventually attended with more or less local manifestations of disease, some of so fixed a character, and so strongly expressed, that the local lesions which may prevail are sometimes looked upon (although erroneously) as constituting distinct diseases; such, for instance, as the joint or heart affection in *rheumatism*, or the bone affection in *rickets*.

The local manifestations of those diseases which belong to the

constitutional class are invariably the expression and result of a pre-existing unhealthy state of the system, without which no outward, extraneous, or accidental condition could call them into existence; although such conditions might determine (as a stimulus would) the local development, external manifestation, or expression of the constitutional disease.

The CONSTITUTIONAL DISEASES are, therefore, all associated with what is termed a *cachectic* state (*cachexia*), or, in common language, "a bad habit of body." They are sporadic diseases, and are sometimes discovered to be hereditary. The lesions which attend them are observed to be rarely limited to one part or organ; and, before death ensues, several organs, tissues, or apparatus, not necessarily contiguous to each other, become diseased, and new materials of a heterologous nature may grow up in their substance.

In the local lesions are to be found those elements which mark the "anatomical characters" or "anatomical signs" of the several constitutional diseases.

We do not yet know why one organ or texture should be either earlier or more constantly affected than another. It cannot be explained why tubercle selects at one time the bronchial glands for its main *nidus*, and the lungs at another; nor why cancer infests by preference the mamma and the uterus; nor why rheumatism affects the white fibrous tissues; nor why rickets affects the bones. The predilections of constitutional diseases to express themselves through lesions of certain organs rather than others are still unexplained.

The course of *constitutional diseases* is generally a prolonged one; the tendency to repeated attacks or paroxysms of morbid action exists throughout life; and the local expressions of disease may ultimately assume a persistent or chronic type, complicated with and complicating diseases of another kind, and mutually aggravating each other.

The primary implication of the constitution is, in the greater number of cases, sometimes demonstrable; but sometimes it can be stated only as a matter of fair induction that the constitution is affected through the blood and the relation of the nutritive processes to it. Pyrexia, when present, is secondary, and generally dependent on the irritation produced by the effort to eliminate some morbid material. The re-absorption of the elements of this morbid material, or a persistence of its existence

in the blood, tends to affect the blood secondarily; and this secondary blood affection tends to produce secondary changes in the solids. Thus the blood changes, and the changes in the solids continue to act and re-act on each other. Thus, also, the constitutional diseases are not traceable to the extrinsic action of a *virus*, and have none of the properties attached to infection. The constitutional diseases are thus apparently generated, developed, and sustained under the influence of an intrinsic blood poison, the result of perversion of the nutritive or assimilative functions of the individual, and are frequently determined by congenital constitution or hereditary tendency. "It seems strongly probable," writes Dr. Walshe, "that each member of the group has its specific morbid principle in the blood, uninterchangeable with the rest, just as any one *virus* is uninterchangeable with others; and that, further, there may exist for each constitutional disease its specific curative agent—an antidote for each poison. In the greater number of these diseases a more or less obvious disposition may be traced to symmetrical arrangement of the anatomical characters of the local lesions, whether these be external or internal."

External physiognomical differences may generally be recognized as distinguishing one man from another, and due to the peculiarities of his own constitution—"*personal peculiarities.*" These are due to what have been called "*temperament,*" combined with that character of the constitution which tends to the repeated expression of some form of ill-health, always in the same way, and to which the name of *diathesis* has been given. Such external differences between man and man—such *personal peculiarities*—are known to be transmitted from parent to child, and are then said to be due to *hereditary transmission.* The *tendency* to the expression of certain forms of disease, being thus born with such children, is said to be due to *hereditary predisposition,* and this tendency may be strong and evident, or it may be but feebly and faintly marked. In the former instance it will become expressed in the midst of circumstances even the most favourable to health. Another remarkable feature in the pathology of constitutional diseases requires special notice—namely, that the transmission of the hereditary tendency may fail to be expressed in the *children* of a family liable to diseases known to be so transmitted; and yet the tendency may appear in the grandchildren. The tendency is thus expressed in *alternate*

generations—the law of "*atavism*," as it has been called. The tendency, thus failing to appear in one generation, may lie dormant, and at last burst forth "in some collateral branch of the family tree;" thus proving that *tendencies* not obviously *expressed* by the parent may nevertheless be *transmitted* by him. A person therefore cannot be considered free from the inheritance of constitutional maladies simply because his parents may not have suffered from any of them: and now it is admitted that, under at least *three generations*, the investigation of hereditary tendency is uncertain.

When one only of the parents is the victim of constitutional disease, the tendency to similar constitutional disease is most obviously expressed in those children who most resemble that parent in physical conformation and appearance; and it has been observed that, when both parents suffer, the tendency will sometimes be expressed more often in the daughters of the family than in the sons, or more often in the sons than in the daughters.

It is especially to be noticed that a marked distinction ought to be made between those which are about to be described as "CONSTITUTIONAL DISEASES" and those which are sometimes called "BLOOD DISEASES." The diseases of the zymotic class, already described, may emphatically be termed "blood diseases"—diseases in which a poison from without affects the blood and establishes a specific disease; but the constitutional diseases about to be noticed are "*blood diseases and something more.*" They not only exhibit an aptitude, possessed by those who suffer from them, to assume peculiar forms of morbid action, but their existence stamps upon every other morbid state with which they may be combined a most untoward effect. Exudations no longer proceed to healthy resolution. A chill, which otherwise in a healthy man would do no harm, is followed by rheumatic pains and swollen joints in one whose constitution tends to rheumatism; or the growth of tubercle may commence in the lungs of one whose constitution is tuberculous. A bruise is followed by inflammation and an unhealthy suppuration, which has been termed scrofulous, in those who are stamped with the diathesis of such a constitutional disease; while the influence of a constitution disposed to attacks of gout or rheumatism is very unfavourable for recovery from wounds, injuries, and other severe diseases. On the other hand, it is to be remembered that local inflammations depending on a constitu-

tional cause are sometimes remarkably fugitive and transient. So much is this the case that an idiopathic inflammation, such as a pneumonia or bronchitis, lasts, as we know, for several days; but it occasionally happens that local affections having all the characters of inflammation will be suddenly established in persons labouring under constitutional *diathesis* or *cachexias*, and these inflammatory affections will run their course and terminate in as many hours as the others may take days—may appear at first even more formidable—but the very fact that they occur in a person suffering from rheumatism or gout enables one to give a more favourable prognosis of the immediate result than would perhaps be warrantable in the case of a person otherwise healthy. This may appear paradoxical; but it is known as a matter of experience that when visceral inflammations appear in the train of rheumatism, for example, they run a materially more favourable course, as a general rule, than if generated under some other influence (GRAVES, WALSHE). This fact it is necessary to bear in mind during the examination of all cases of constitutional diseases, for it may help to explain many apparent anomalies amongst the diseases of this class.

Dr. Walshe has specially called attention to the very complex and dangerous forms of disease which result when miasmatic and enthetic diseases (or, as he terms them, acute specific diseases) are complicated with the diathesis of constitutional diseases. He shows, further, that constitutional diseases and miasmatic diseases, when they co-exist, exercise an unfavourable reciprocal influence upon each other (*Med. Times*, 1855).

The reader will therefore be pleased to observe and remember that the term "CONSTITUTIONAL," applied to disease as used in this text-book, is not synonymous with GENERAL or EXTENSIVE, as used by some writers.

The diseases of this class are conveniently arranged into the two following orders, namely:—(1.) *Diathetic diseases;* and (2.) *Scrofulous, tubercular, phthisical,* or *wasting diseases.*

CHAPTER II.

DETAILED DESCRIPTION OF THE DIATHETIC ORDER OF CONSTITUTIONAL DISEASES.

Diseases belonging to this order are represented by *rheumatism* and *gout*, also by those affections in which an alteration in the proportions or qualities of the elements of the blood is the obvious and prominent fact, such as *anæmia*, *leucocythemia*, *cyanosis*, and probably the *morbus Addisonii;* and, lastly, by those diseased states of the constitution which manifest themselves by such alterations of the urine as are sufficiently indicated by the *oxalic acid*, the *xanthic oxide*, the *cystic oxide*, the *lithic acid diathesis*, the *diabetic state*, *Bright's disease*, *beriberi*, *rickets*, *asthma*, and the like.

With reference to the term "diathesis," it is to be explained that there are certain states of the human body which physicians have called "morbid dispositions" (*diathesis morbosæ*). The term *diathesis* is used extensively, and sometimes vaguely. By it pathologists have meant to designate often an unknown, impalpable, undefined state of the human constitution, the existence of which is sometimes assumed, or is sometimes legitimately inferred by inductive reasoning, and which then is made to explain the characteristic tendency of some morbid constitutional state, which betrays itself by repeated local manifestations of morbid action (Craigie). A *rheumatic diathesis*, a *gouty diathesis*, a *cancerous diathesis*, a *lithic acid diathesis*, are all thus spoken of. It is now, therefore, generally understood to imply—(1.) The existence of *latent* conditions in the constitution of the body itself, necessary for the development of peculiar diseases; (2.) A tendency to the development of special and peculiar diseases during the course of the nutrition and other morphological changes between the solids and fluids of the body, and which are only influenced by the operations of agents from without, acting as stimuli or excitants to the morbid development.

ACUTE RHEUMATISM—Syn., RHEUMATIC FEVER.

Latin Eq., *Rheumatismus acutus*—Idem valet, *Febris rheumatica;* French Eq., *Rhumatisme articulaire aigu;* German Eq., *Acuter Gelenk-rheumatismus*—Syn., *Rheumatisches Fieber;* Italian Eq., *Reumapira*—Syn., *Febbre reumatica.*

Definition.—*Febrile excitement of a specific kind, probably due to a morbid state of the system by constitutional development, and expressed by inflammation of a peculiar and non-suppurative kind in the parts about or surrounding the joints, especially in the white fibrous tissues—such, for instance, as the sheaths of the muscles and muscular fibres, tendons, aponeurosis, bursæ, capsular ligaments, periosteum, and pericardium. Many joints may be affected at the same time or in succession. The various local phenomena of the disease have a tendency to shift from part to part, the most remote from each other; and the febrile state is accompanied by profuse acid excretions from the skin, by the separation, in some cases, of large quantities of uric and sulphuric acid through the kidneys, and by a highly fibrinous condition of the blood.*

Pathology.—Various opinions have been entertained from time to time regarding the nature of this disease. It was believed to be of miasmatic origin; but the most recent inquirers into the nature of rheumatism (Basham, Garrod, Fuller) show that it acknowledges no general external source, and it is not even yet demonstrated that any definite offending matter or poison pervades the system. It is presumed, however, by inductive reasoning, that some morbid material is generated by and within the bodies of those in whom rheumatism is fully developed, and that it is not absorbed from without.

Evidence of the poisoned state of the blood exists in—(1.) The symmetrical development of the local symptoms—a phenomenon which obtains in all disorders connected with a vitiated condition of the circulating fluid (Budd); (2.) The constancy of premonitory fever, or of fever associated with the progressive development of the disease, with a large number of local symptoms, and lesions of internal organs, occurring simultaneously; (3.) A series of observations by Chomel (*Leçons de Clinique Medicale*) tend to show that the internal inflammations in rheumatism, like those of *small-pox, typhus, scarlatina,* and the like, are refer-

able to an alteration of the animal fluids, and more especially of the blood; (4.) The phenomena of metastasis, when it does occur, points to a morbid matter in the blood itself as an explanation of the occurrence (HOLLAND, FULLER). The most constant morbid condition of the blood in rheumatism is the abnormal relative proportions which become developed between the *fibrine* and the *saline* elements; the mean of the *fibrine* to the *saline* elements being in the relative proportion of 7·163 to 8·478 in 1,000. In normal blood the *fibrine* rarely exceeds 3 in 1,000.

The following circumstances point to the constitutional origin of this disease—(1.) The victims of rheumatism are apt to experience symptoms clearly denoting at an early period of life certain functional derangement, which leads to impairment of general health (FULLER, TODD, and CHOMEL). (2.) Rheumatic patients are sensitive to atmospheric vicissitudes, prone to perspire, and their perspiration has a sour, disagreeable odour, whilst their urine, though usually clear when passed, not unfrequently deposits, *on cooling*, a red, brick-dust sediment of lithates and lactates. By such constitutional signs the "rheumatic diathesis" is indicated. (3.) The heart of such persons is irritable, and prone to take on inflammatory action, and its nutrition is apt to become perverted. (4.) A change of the mode of living has been observed to induce the rheumatic diathesis. (5.) The long continuance and frequent recurrence of symptoms, or paroxysms of the disease, also point to a constitutional origin of the *materies morbi* of rheumatism.

It was first suggested by Dr. Prout that all the phenomena of rheumatism are referable to the presence of lactic acid developed too freely or abundantly in the system—a suggestion adopted by Drs. Furnivall and Todd, and subsequently by Drs. Headland, Fuller, and Mr. Spencer Wells. Before the starch of the food can be applied to the maintenance of animal heat, it has to be converted into lactic acid, which then combines with oxygen to form carbonic acid and water; and whatever tends to interfere with this normal series of changes from taking place may lead to the accumulation of lactic acid, or other allied acids, in the system.

Dr. Fuller believes the poison of rheumatism to be identical with some natural excretion of the skin, and he grounds his belief chiefly on the following circumstances:—(1.) That when the skin's action is interfered with, especially in old people, pains

or stiffness of a rheumatic character are generally the consequences; (2.) That the perfect development of the means which nature adopts to relieve these symptoms suggests a relationship between rheumatism and cutaneous excretion. "No sooner is a person attacked by the disease," writes Dr. Fuller, "than excessive perspiration is set up, as if with the view of getting rid of some peccant matter, and the secretion is most profuse at the very part where local inflammation is taking place." Nevertheless, although rheumatism is undoubtedly stamped with a peculiar and specific character, yet the material morbific matter is as yet undiscovered. The exact conditions of the system under which the disease becomes developed are hitherto undetermined. Both Dr. Craigie and Dr. Watson hold that rheumatism implies inflammation of a peculiar and specific kind; and the latter goes a step farther, and writes that "Rheumatism is a blood disease,—that the circulating fluid carries with it a poisonous material which, by virtue of some mutual or elective affinity, falls upon the fibrous tissues in particular, visiting and quitting them with a variableness that resembles caprice, but is ruled, no doubt, by definite laws to us as yet unknown."

Dr. W. B. Richardson made some very important experiments to try whether the theory that superabundance of lactic acid in the system induces pathological phenomena of the rheumatic type admits of any direct demonstration. He injected into the peritoneum of a healthy cat seven drachms of a solution of *lactic acid,* with two ounces of *distilled water.* Two hours after the operation the action of the heart became irregular. The animal was left for the night about six hours after the operation, and in the morning was found dead. The inspection showed *no peritoneal mischief,* but the most marked *endocarditis* of the left cavities of the heart. The mitral valve, thickened and inflamed, was coated on its free borders with firm fibrinous deposit. The whole endocardial surface of the ventricle was intensely vascular. This experiment was afterwards repeated on two healthy dogs. The first dog died on the second day after the experiment, and the inspection revealed the most striking pathological signs of *endocarditis.* The tricuspid valve was inflamed, and swollen to twice its ordinary size. The aortic valve, swollen and inflamed, was coated on its free border with fibrinous beads. The endocardial surface was generally red from vascularity. The pericardium

was dry and injected. As before, the *peritoneum escaped injury.* The joints were not affected, but there was distinct *sclerotitis* in the left eye. These experiments demonstrate that *endocarditis* may be physiologically produced by lactic acid (*Medical Times and Gazette,* July 18, 1857). Similar experiments, with similar results, are reported by Dr. Brinton to have been made about eleven years previously by Mr. Simon, of St. Thomas's Hospital (*Transactions of Med. Soc. of London,* Jan. 23, 1858, reported in various Journals).

Whatever, therefore, the poison may be which induces the rheumatic state, it is one which appears to be generated within the system as the result of faulty metamorphosis—that many agencies may conduce to the formation of the poison, and to its retention within the system. Whatever the poison may be, it does not seem to be absorbed from without. It is inbred, and not derived from extrinsic sources. The researches of Dr. Parkes lead to the belief that it is some substance rich in sulphur.

The parts affected in rheumatism are for the most part the *ligaments, fasciæ, aponeurosis, periosteum, perichondrium, tendons, bursæ, and serous membranes of the heart and brain;* but the *joints* and surrounding structures are the parts most frequently affected; and *the heart, the kidneys,* and *the arteries* all sometimes suffer. A red and injected state of the vessels of some of these structures is often the only evidence after death of the existence of any approach to inflammatory action, especially in the synovial membranes, the pericardium, or membranes of the brain. This diffuse redness and injection of the vessels may terminate by resolution, or serum may be effused. *Serous* inflammation is extremely common, and is evinced by the swollen state of the bursæ and parts external to a joint, often by an evident fluctuation within the cavity of a joint; and should the patient die, the cavities of the arachnoid and of the pericardium may be found loaded with serum, the latter often to the extent of many ounces.

One of the most frequent results of acute rheumatism is the tendency to thicken parts, and to cause opposing surfaces to adhere. The connective tissue surrounding the diseased articulation is often not only found thickened, but infiltrated with a loose coagulable lymph. The tendinous sheaths and capsular ligaments sometimes exhibit the same alterations. After a time the new

material becomes consolidated, and in this manner parts are bound down, and the motion of joints greatly and sometimes permanently impaired. The alterations of the synovial membrane are not the least curious of the changes which occur in rheumatic joints from the adhesive process. The tissue is not only often thickened, but villous processes, like the papillæ of the tongue of herbivorous animals (only soft and red), and dipping into the depressions around the neck of the bone, are occasionally formed, which are intractable even to long treatment, and often lead to destruction of the joint. The strongest evidence of the tendency to thickening, consolidation, and adhesion of parts may be seen in the immense effusions of lymph which take place in *rheumatic pericarditis*, sometimes covering the whole surface of the heart and pericardium with a layer of lymph half an inch in thickness, and whose irregular surface has been compared to a honeycomb, a calf's stomach, or to the external aspect of a pine-apple.

It is rare that the exudative process in acute rheumatism advances to suppuration. It has been observed, however, sometimes in the muscles, but more commonly within the capsules of the joint (Stohl, Chomel, Moreau, Piorry, Cruveilhier, Bouillaud, Macleod).

Ulceration of texture in some parts affected is by no means unusual in cases of rheumatism, sometimes perforating capsular membranes or destroying ligaments, but more frequently eroding cartilages and the ends of bones. A remarkable change sometimes takes place in the bones of rheumatic joints when the cartilages have been lost. They become enlarged, and almost eburnified from increased ossific deposit, causing not only a change of form in the articular extremity, but presenting a mechanical obstacle to the motion of the joint. When the hip-joint is affected, the acetabulum becomes deeper and wider than natural, and the head of the femur, flattened and expanded, assumes something of the shape of a turnip.

The parts most commonly affected are the joints, and such textures as are composed principally of the white fibrous tissue. Accordingly, the valvular apparatus of the heart, its fibro-serous covering, the strong white glistening sac of the pericardium, are parts which most frequently suffer. Some joints are more prone than others to be attacked, such joints also being more exposed, as the knees, the feet, the ankles, the wrist, and the hands are the

parts most commonly implicated; next in order, perhaps, follow the elbows, and then the shoulders and the hips. The larger joints suffer more frequently than the smaller, and the small joints of the hands and fingers more commonly than those of the feet. Joints which have been injured, such as those which have been sprained, are more apt to suffer than others; so also those parts which are exercised violently, when that exercise is long continued. There is a tendency to the symmetrical implication of joints.

The constitutional expression of the disease may persist without the implication of any external organ; but not unfrequently the investing or lining membrane of the heart becomes inflamed, and so do the lungs or pleuræ—complications whose existence had been long unnoticed, or at least unconnected with the state of rheumatism.

The heart affections embrace both the immediate and the subsequent dangers in an attack of rheumatism. The occurrence of the heart affection was at one time considered as due to a retrocession of the disease from the external parts, and its consequent transfer to the membranes of the heart. But endocardial or exocardial inflammation may occur as the first, and be for some time the only local symptom of the disease (WATSON, HOPE, HACHE, GRAVES, TAYLOR, FULLER, and others). *Acute rheumatism* and *pericarditis* may also co-exist without any articular affection (HACHE, GRAVES, TAYLOR); and the cardiac complication sometimes even *precedes* by *several days* the access of articular redness and swelling; and even in cases where it does not take place until after inflammation of the joints has been set up, it is rarely preceded or accompanied by subsidence of the previously existing articular inflammation. In other words, in the great majority of cases it has been shown that no connection can be traced between the two sets of actions, beyond their origin in one common source of mischief—in one poison which excites inflammation now at one spot and now at another; at one time attacking several joints simultaneously, or in succession, and then the investing or lining membrane of the heart; at another time reversing the order of attack, and exciting inflammation first of the heart and then of the articular structures. Hence, although rheumatic inflammation of the heart may possibly be connected in some rare instances with the sudden subsidence of articular inflammation and the transfer of irritation from the external parts, it must be regarded in most instances as a mere

coincidence, and as an extension of the local manifestations of the disease (FULLER).

As a general rule, like the severe cases of articular rheumatism, the occurrence of cardiac complication may be expected in cases remarkable for the severity of their general symptoms. But from the nature of this disease *all cases are liable;* and the cardiac symptoms may for a time be the only ones. Hence has arisen the apparent difference of opinion as to which are the cases peculiarly prone to heart disease. Dr. Latham and Dr. Watson state that "pericarditis is not more to be looked for when the disease is severe than when it is mild;" but, according to the experience of Dr. Fuller, it is inconsistent to believe that it often occurs in cases which are not characterized by active symptoms of disease. "Whenever I have met it," he writes, "even though the articular inflammation may have been slight or evanescent, the febrile disturbance has always been severe, and accompanied by profuse and sour-smelling perspiration." His experience expressed numerically stands as follows:—"That whereas pericarditis occurs *once* in about every 6·3 patients suffering from *acute* rheumatism, it does not accompany above one in every 66·5 cases of the sub-acute form;" and his experience in this respect is consistent with that of M. Bouillaud, Drs. Macleod, William Budd, and Copland. In many instances the heart remains unaffected throughout the attack; and though it does sometimes suffer even in the milder cases, it is most commonly damaged in those instances which are marked by unusual severity of their general symptoms, by the number and intensity of the articular inflammations, and by the rapidity and frequency of their migration. It is found in youth, in women rather than in men, in those persons who have been weakened by illness, or by large and repeated bleedings, and in those peculiar states of the system marked by a deficiency of red globules in the blood, when the heart's irritability is much increased, and palpitation is readily induced. These are the cases in which cardiac inflammation is most liable to arise during an attack of rheumatism (FULLER).

The forms of disease from which the heart is apt to suffer in cases of rheumatism are—(1.) Inflammation of the pericardium or endocardium; (2.) Inflammation of the substance of the heart itself; (3.) Fibrinous vegetations on the valves and on the lining membrane of the heart, independent of endocardial inflammation.

These vegetations, like other exudations, are doubtless common in endocarditis, but they are essentially independent of endocardial inflammation, and may take place without its occurrence, while endocardial inflammation does not necessarily produce them (KIRKES, ORMEROD, FULLER). These fibrinous deposits seem to be more immediately connected with the abnormal condition of the circulating fluid; for they are almost entirely confined to cases accompanied by acute and wide-spreading inflammation, and by conditions productive of unusual quantities of fibrin in the blood, and which tend to impair its solubility. The statistics of Dr. Barclay, in the *Med.-Chir. Trans.*, vol. xxxi., confirm these observations.

But although endocardial inflammation may fail in the first instance to produce the fibrinous deposits on the valves, yet such endocardial attacks leave behind them a tendency to endocardial degeneration. The most common lesion which thus results is the fibroid degeneration of the valves—a rheumatic lesion which may occur without any articular symptoms. It slowly advances from year to year, with a gradual but constant and more undoubted expression of symptoms; and ultimately the implication of important viscera (*e. g.*, fibroid degeneration of the kidneys, œdema and anasarca) ensues.

Rheumatism is often protracted and rendered complex by other lesions besides those of the heart. The different muscles of the body, their fascia, or tendons, in addition to the joints, or independent of them, are often the seat of rheumatism, and there are few structures of this kind that entirely escape. The scalp, for instance, is often affected. The muscles of the eye are occasionally so: Stohl quotes one case in which the patient squinted while the disease lasted. Rheumatism of the face is by no means unfrequent, and the muscles of the larynx are occasionally affected, causing aphonia. Everybody is familiar with the rheumatic affection termed "crick in the neck," "*stiff neck*," and which at the same time may affect the articulations of the clavicle and intercostal muscles. Rheumatism of the abdominal muscles is by no means rare, the principal pain being at their insertions into the *crista* of the ilium. *Lumbago* is well known as a rheumatic affection of the sheaths of the fleshy mass of the lumbar muscles, on one or on both sides of the loins, extending often to the ligaments of the sacrum. The pain is increased by every movement

of the back, or pressure on the muscles implicated. The insertion of the *tendo Achillis* into the *os calcis* is another frequent seat of rheumatism; but no parts are more often or more painfully affected than the tendinous structure of the soles of the feet. When the neurilemma of the sciatic nerve is affected, such rheumatism is one form of *sciatica*. *Pleurodyne* designates the rheumatism of the intercostal muscles, or the fibrous fascia which encloses them. These forms of muscular rheumatism are seldom accompanied by any swelling or other external symptom.

When catarrhal affections are prevalent, inflammation of the lungs or their investing membranes may be expected. Acute inflammation of the sclerotic coat of the eye is not uncommon, and appears to be most of all liable to occur in cases where the tendency to gout prevails as well as the rheumatic condition. Inflammation of the brain or of the investing membranes is one of the most frightful but happily rare complications. Cases of active maniacal delirium, sympathetic and symptomatic, of cardiac or pulmonary disease, or of the general vitiated condition of the circulating fluid, have also been recorded.

"It is worthy of note," writes Dr. Fuller, in conjectures regarding the reason why constant lesions of particular textures occur in rheumatism, "that the textures most commonly implicated are all examples of the albuminous and gelatinous tissues, from the decomposition of which, in the wear and tear of the body, are formed those secondary organic compounds, the lithic and lactic acids, with which gout and rheumatism are intimately connected;" and probably also, he might have added, the increase of fibrin, as John Simon has conclusively indicated. It may be for this cause, therefore, that the rheumatic poison has a special affinity for the fibrous and fibro-serous textures throughout the body, and fixes more especially upon those which are in any way subject to irritation. According to the intensity of the febrile disturbance, *as measured by the thermometer*, so, *cæteris paribus*, would appear to be the liability to inflammation, whether of the joints, the heart, or any other part of the body; and the increase of temperature above 98·4° Fahr. will give a tolerably accurate measure of the amount of the poison present in the system, and of the patient's susceptibility to its influence. The number and intensity of the articular inflammations, and the proneness they exhibit to shift their quarters, serve also as guides to the proba-

bility of heart or other internal affections; and the extreme liability to cardiac inflammation, engendered by the repression or rapid subsidence of the articular inflammation, is explicable by the greater quantity of the poison which is thus suddenly thrown into the blood's current (FULLER).

Rheumatism may be acute or chronic; but the proportion of cases of the latter is infinitely greater than of the former.

The varieties of rheumatism are as follows: — (1.) *Acute Rheumatism;* (2.) *Sub-acute Rheumatism — a disorder analogous to the acute, but "of moderate intensity, with little or no febrile disturbance;"* (3.) *Gonorrhœal Rheumatism—an analogous affection associated with gonorrhœa;* (4.) *Synovial Rheumatism—a rheumatic affection in which an accumulation of non-purulent fluid occurs in the synovial sacs, and especially in those of the knee-joints;* (5.) *Muscular Rheumatism—pain in the muscular structures, increased by motion.* The local varieties are — (*a.*) *Lumbago,* (*b.*) *"Stiff neck,"* (*c.*) *Chronic Rheumatism—chronic pain, stiffness and swelling of various joints.*

Symptoms. — Acute rheumatism expresses itself by a severe inflammation of the feet, of the hands, or of the larger joints, as the wrist, ankle, knee, hip, elbow, and shoulder-joint, or of one or more of these parts, and this is usually accompanied by severe inflammatory fever. These affections often constitute the whole disease; but in some cases, either with or without the subsidence of the articular inflammation, the heart or pericardium, or the membranes of the brain, become the seat of rheumatic inflammation. The proportion of persons whose heart is thus affected probably varies according to the treatment, and other circumstances noticed in the former section. Bouillaud estimates the number at more than one-half, or as 64 in 114 cases, and Dr. Macleod at one-fifth. The affection of the membranes of the brain is much more rare, but the proportionate number is not determined.

In an attack of acute rheumatism the fever often precedes by twenty-four or forty-eight hours the inflammation of the joints; but this is not constant, for in some instances the local and general symptoms are contemporaneous, while in others the inflammation of the joints is established before the accession of the fever.

The fever which attends acute rheumatism is well marked and

striking, and symptoms of functional derangement present themselves long before its full development. Before actual fever is established, the patient feels "out of sorts," and unusually sensitive to atmospheric vicissitudes; he looks pale, with a sallow, unhealthy complexion, and a dull eye with yellowish conjunctivæ. The chilliness or shivering with which, in common with other acute fevers, it is ushered in, speedily passes away, and is followed by great heat of the skin, and by copious but partial perspiration, almost invariably acid, reddening litmus paper, and of a disagreeable sour odour. It is a mistake to suppose that much perspiration is useless. It is nature's cure for the disease. It may be "wasting and enfeebling," as excessive perspiration always is, but it is highly sanative; and if it does not occur, the pains are always more excessive, and the constitutional symptoms become more severe if perspiration should unexpectedly cease. The *materies morbi* is obviously got rid of by the sweating, and the natural cure of the disease is effected by these profuse sour-smelling perspirations. Those perspirations are only useless when they are not of this characteristic sour description. They are then emphatically "useless, wasting, and enfeebling," and ought to be arrested. The urine in *acute rheumatism* presents the strongest type of the so-called febrile urine (PARKES, l. c., p. 286). It is scanty, of high specific gravity, deeply pigmented, and deposits, *on cooling*, deep-coloured sediments of urates. It very much resembles pea-soup. The water is lessened; the total solids augmented (chiefly by increase in urea and pigment); and the urea in most cases is very considerably augmented. Dr. Parkes has observed an excess of *one-fourth* or *one-fifth* over the physiological amount; and the amount is greater in equal periods during the day than during the night; and when the very spare diet of rheumatic patients is considered, the great disintegration of nitrogenous tissue is obvious,—represented as it is by a daily excess of from ten to twenty *grammes* of urea. The uric acid at the same time is somewhat increased; and there is usually a great quantity of water passed during the height of the disease, and at the commencement of improvement, or some days afterwards. The chlorides are often diminished, and sometimes disappear. Dr. Parkes has found a very great increase in the elimination of sulphuric acid, being sometimes double that passed during convalescence. The analyses of others have shown no increase. The

pigment and extractives are always greatly increased. Albumen appears in some cases, generally small in amount, and very transient; the kidneys suffer much less frequently and much less profoundly than in many other diseases where the system generally is so much out of order. The pulse rises to 90, 100, and 110, and is large, full, and strong; and if the temperature rises above 104° Fahr., the chances of danger increase, and the case is a severe one. The tongue has usually a creamy-like covering, and is greatly loaded with a white or yellowish-white mucus; the bowels sluggish; the evacuations dark and offensive. There are many remarkable differences between this and the phenomena of continued fevers; for it runs no given course, is not marked by changes of the tongue, nor by any great depressing action; while delirium and headache even are of rare occurrence.

Dr. Sydney Ringer, the Professor of Materia Medica in University College, has made some very accurate and extremely interesting observations on the range of temperature in three cases of acute rheumatism, and he has kindly permitted me to make use of his MS. notes.

The concurrent phenomena in one of his cases (a man twenty-three years of age) may be shortly stated as follows:—

On the evening of the *third day*, two days after rigors, the temperature in the axilla indicated 102·6° Fahr.: at ten o'clock at night of the same day it had fallen to 101·4°. The face was flushed, the eyes bright, the lips rather dry, the skin very hot to the feel, and dry, the tongue very red and rather dry; and thirst was greatly complained of. The bowels, hitherto confined, had been opened by medicine. Pulse, 150; respiration, 36. Some dulness underneath the right clavicle. Enlargement of the liver.

On the morning of the *fourth day* (at nine A.M.) the temperature had fallen to 100° Fahr.; by noon of the same day it again rose to 103°; in the afternoon it fell to 102·6°; and by ten o'clock at night of the same day it had again risen to 103·4°.

He had passed a quiet night, without delirium, sweated much, looked better in the morning, was less flushed, and had a moist skin. Much pain and tenderness in both shoulders for the first time yesterday. Seized with pain in the left knee during the night, which was very severe. Left knee is greatly swollen; the swelling is tense, pushing the patella before it, rising some distance above and round that bone. No local redness, but some

heat; has had frontal headache for several days; tongue red and rather dry at the tip; thirst less; bowels opened several times during the night; edge of liver rather rounded, can be felt as low as the umbilicus; heart appears displaced somewhat towards the middle line—sounds normal—no friction; pulse, 120, weak; respiration not hurried; no action of nares; urine contains a large quantity of lithates and a small amount of albumen. No casts nor blood seen on microscopic examination.

On the morning of the *fifth day* (at nine A.M.) the temperature had fallen to 103°, where it remained till three o'clock P.M. At seven in the evening it had fallen to 102°, after which it began to rise, and continued to rise till ten o'clock at night, when the thermometer indicated 104·6° Fahr.

He had slept badly during the night, and perspired freely. His complexion has acquired a sallow appearance, and the conjunctivæ are jaundiced. *Sordes* exist about the teeth and gums. Pain in both shoulders, in elbows, and in left knee; no pain in other joints, nor in the head. Tongue red and dry; much thirst; bowels open twice; heart healthy. About ten o'clock at night he complained of great pain over the lower part of the sternum; and friction is heard with the systole at the base of the heart; and there is pain in the chest, which is rather increased by breathing.

On the morning of the *sixth day* (at nine A.M.) the temperature had fallen to 101°, and by noon had only risen $\frac{8}{10}$ths of a degree; but by four P.M. the thermometer indicated 104·8°, after which it continued to fall till 9·30 P.M., when it indicated 100° Fahr.

He had passed a very restless night, and was delirious. The features appear shrunken and very sallow; the conjunctivæ yellow. *Sordes* exist on the gums and teeth; sudamina on the chest; sweated freely; pain in the right shoulder and elbow, none in the left. No redness, no swelling, and no tenderness save only on movement; but the pain and swelling still continue in the left knee; pulse, 106, weak; friction at the base of the heart, the same as the previous night; bowels moved once daily, the motions being liquid, and of a pale yellow colour.

On the morning of the *seventh day* (at nine A.M.) the temperature was 104°; at noon of the same day it had fallen to 102°; in the evening (six o'clock) it registered 101·6°, after which the

temperature continued to rise slightly till nine at night, when the thermometer indicated 102·2°.

He had been delirious during the night. *Sordes* exist on the teeth and lips; face and chest distinctly but not intensely yellow; perspired much during the night. No pain when at rest, but on movement there is pain in the right shoulder and elbow, also in both knees. Right knee is now tender, but not swollen; tongue dry and red; motions pale; much thirst; heat as before; slight cloud of albumen in the urine.

On the morning of the *eighth day* (at nine A.M.) the thermometer indicated a temperature as high as 104·2° Fahr.; in the afternoon (two P.M.) it had fallen to 103°, and rose again slightly in the afternoon.

Emaciation has advanced rapidly; he lies in an apathetic state, with the eyes partially open, and mucus begins to cover the cornea. Conjunctivæ finely injected. Delirium during the night, but replies to questions reasonably in the morning; yellowness increased; right knee much more swollen, the left less so; tongue very dry; no increase of dulness over the heart; slight friction sound still heard at the base; no endocardial murmur; urine high-coloured, no albumen.

On the morning of the *ninth day* the thermometer indicated 103° Fahr. By noon of the same day it fell to 101·4°. It rose slightly in the afternoon, and remained at 102° Fahr.; at nine P.M. is getting worse and losing flesh rapidly. He lies with his eyes almost closed, noticing nothing, but answering questions correctly; yellowness more marked in the conjunctiva; right knee swollen; swelling of right ankle; liver much less enlarged—a distance of four fingers' breadth between its margin, as now felt, compared with the line to which it formerly reached; motions liquid and dark-coloured; heart's boundaries as before; no friction sound.

On the morning of the *tenth day* (at nine A.M.) the temperature had risen to 103°, but fell towards noon to 102°. In the afternoon it had again risen to 103·2°, after which it again began to fall.

On the morning of the *eleventh day* (nine A.M.) the thermometer indicated 102·8°, and by noon it had fallen to 102°. During the afternoon it rose again steadily, and by ten at night it registered 104°.

On the morning of the *twelfth day* (at nine A.M.) it had fallen to 101°, but by noon it had risen to 103·3°, after which it fell in the afternoon to 102·2°, but rose in a short time again to 103·4°, falling in an equally short time to 102°, where it remained at eight o'clock at night.

On the morning of the *thirteenth day* (nine A.M.) the thermometer had risen to 105·4° Fahr., when he was moribund; and it remained at that high temperature till death in the afternoon.

At the *post-mortem* examination an abscess was found in the right sterno-clavicular articulation, and much clear tenacious fluid of a yellow colour was found in many of the joints.

Universal pericarditis surrounded the heart, but no fluid effusion existed to any extent.

The liver weighed eighty ounces, the left lobe being enormously enlarged, and the right diminished. Its substance was deeply notched, giving a lobulated appearance to the organ. On section it is very firm and rather pale. The lobules are very much enlarged, and distinct from each other. An excess of fibrous tissue is seen by the microscope to surround the lobules, the cells of which look pale and free from granules. The spleen was much enlarged, but normal. The kidneys were much enlarged and congested; and the pyramids were marked by opaque streaks of fat.

This case and others indicate remarkable vacillations of temperature, occurring irregularly during the day; and they show a very high temperature, met with occasionally before death—in some cases as high as 109·6° and 110°.

If the student will project upon paper, in the same way that such records have been already indicated in diagrams, the ranges of temperature so minutely recorded by Dr. Ringer, he will be better able to appreciate, at sight, the vacillations of temperature referred to.

These phenomena are associated with acutely painful, hot, and swollen joints; thus the local symptoms which accompany the inflammation of the articulations are pain, heat, redness, and tumefaction. The *pain* is generally active and severe, although in a few cases it is latent—that is, the patient is at ease, unless the joint or limb be moved. At first the pains may wander capriciously from limb to limb, and produce more or less temporary stiffness. It has many degrees of intensity, being in a few instances trifling, but more commonly atrocious and agonizing;

and, though generally constant, it is sometimes intermittent. In all cases in which it exists it is greatly augmented by pressure, so that the slightest touch—even the weight of the bed-clothes—is insupportable; it usually somewhat remits during the day, and is aggravated at night. The *heat* of the inflamed joint is constantly increased, the thermometer indicating a temperature of 100°, 105° Fahr., or even more. *Redness,* though not universally present, is nevertheless the rule, and the affected joint is surrounded by a rose-coloured blush, evanescent on the slightest pressure, yet returning on its removal. The *tumefaction* of the part is generally so considerable that the shape of the hand, the ankle, or other joint, is completely destroyed. In affections of the knee the patella is often more or less displaced by effusion into the cavity of the joint; and this, together with the swelling of the external parts, obliterating all the markings of its healthy state, renders the knee misshapen and rounded, "The surrounding skin becomes dry, tense, and shining—so much so, indeed, that experience alone enables us to predict that suppuration will not take place."

One of the most remarkable and suggestive facts in regard to rheumatism is, that "the fever and constitutional distress are not always commensurate with the extent and intensity of the local symptoms." The rheumatic inflammation of the joints is very frequently *preceded* by febrile disturbance; and sometimes the fever runs so high before any local symptoms have been established, that even cautious and intelligent practitioners may mistake the nature of the impending attack. Moreover, when febrile symptoms do thus precede the establishment of local inflammation, they are not only not increased by its occurrence, but they are very generally relieved, the pulse becoming calmer, the countenance less anxious, and the patient altogether easier (SYDENHAM, FULLER).

Such are the general and local expressions of a diseased state of the system in acute rheumatism; and at the height of the disorder it is difficult to conceive a more complete picture of helplessness and suffering than that to which the patient is reduced. A strong and powerful man, generally unused to disease, lies on his back motionless, unable to raise his hand to wipe the drops which flow fast from his brow in the paroxysms of pain, or the mucus which irritates his nostril. Indeed, he is so helpless

that he is not only obliged to be fed, but to be assisted at every operation of nature. The sweat in which he lies drenched seems to bring him no relief; his position admits of no change; if he sleeps, his sleep is short, and he wakes up with an exacerbation of suffering which renders him fretful, impatient, and discontented with all around him.

The duration of acute rheumatism is various; in some cases both the fever and local pains are gone in three or four days, but in the majority of instances they continue till about the tenth to the fourteenth day, when the fever disappears and the pains begin to subside; and towards the close of the third week or the beginning of the fourth, the patient is recovered, and generally without injury to the joints affected. In almost all cases, however, the pain continues till after the fever is gone, and sometimes for a very long period afterwards. Dr. Fuller's observations lead him to believe that under ordinary methods of treatment the disease endures from four to five weeks, and patients are generally able to leave an hospital about the end of the sixth week; and he considers that the average duration of an uncomplicated attack may be reduced by judicious treatment from a month or five weeks to ten days or a fortnight. The patient, though recovered, is liable to relapse, and often suffers from it.

The symptoms which indicate cardiac mischief are pains or soreness all over the chest, increased on pressing between the intercostal spaces, and also on taking a deep breath. The patient is restless, his countenance anxious, and occasionally he coughs. On applying the stethoscope to the chest a murmur may be heard, loud and permanent, and evidently arising from some irregular contraction about the orifices of the heart or from some affection of the valves. Many physicians believe that the exact pathological state of the pericardium can always be determined. Thus, if the inflammation be diffuse, we shall have a crackling sound like that of new leather, the parts being dry; or if serum be effused, we shall find the heart moving in a larger space than usual. Again, if lymph be poured out, we shall have a rubbing sound; and, lastly, if pus be poured out, it will be determined not only by the greater space in which the heart moves, but by the sudden collapse and rapid sinking of the patient. (See "Pericarditis," &c.)

If the disease be severe and neglected, the patient may die in three or four days, of this secondary affection; but under proper treatment the complication seldom continues beyond a week. If this attack be altogether neglected, and the patient survive, the pericardial surfaces either become adherent or the valves of the heart become permanently diseased; and the ulterior effects of these lesions are dropsies, asthma, or affections of the lungs, which baffle all the resources of our art, and ultimately they are to be classed among the most fatal maladies incident to humanity.

The pain in chronic rheumatism is often latent, unless the part be moved, and then the agony is severe. In many cases it is quiescent during the day, but it is extremely acute during the night. This pain has a great tendency to shift from joint to joint, often subsiding and again recurring. Redness is rarely present in chronic rheumatism; and, indeed, pain is the character by which it is most commonly indicated; so that the term "pains" is not unfrequently understood to mean "chronic rheumatism." In military medical practice much caution and circumspection is necessary in assigning to "pains" alone their proper significance.

It is often impossible at first sight to state positively, from the appearance of a soldier, whether a man who complains of "pains" is or is not suffering from chronic rheumatism, expressing itself by "pains" amongst the extensive white fibrous tissues which constitute the sheaths of the muscles, the covering of the bones, and the ligaments of the joints. The man may really suffer excruciating pains in the muscles of a limb, or in the fibrous tissues round a joint, and may be quite incapable of using his limbs in any way, or at all events of performing the active duties of a soldier; and yet there may be no appreciable heat or local swelling—no material disturbance of the system at the time—no altered state of the tongue or disturbed condition of the pulse, to indicate what he really suffers. Such cases must have the benefit of the doubt, with due caution to prevent "pains" *becoming epidemic* amongst the men. The military medical officer must therefore be prepared to meet with two classes of cases, namely, —(1.) Old soldiers who have previously suffered from rheumatism, or who are predisposed to the disease, and, it may be, "worn out" by previous disease and mode of life, and who suffer from chronic rheumatism, expressed by "pains" diffused over all

the joints and general fibrous tissues of the body. The continued exercise of military duties induces so much fatigue that the digestive functions become impaired, and "pains" are induced. Such men must not be regarded as schemers. (2.) Another class of men present themselves with "pains," who have resolved, by all and every means in their power, to escape as much duty as possible, and endeavour to make the hospital a house of refuge. "Pains" are complained of in the knees, hips, shoulders, or loins; yet the men may be in good health. Such men, in the first instance, must also have the benefit of the doubt till, by care and patient investigation of all the phenomena of life in those men, the nature of the case is fully made out (Gordon, in *Indian Annals*, 1860). Records of temperature taken regularly and continuously will be found especially useful in coming to a conclusion regarding such cases.

The lesions of motion vary from mere stiffness to an entire binding down of the joint. In this manner the hip and shoulder may be so firmly fixed that the arm cannot be extended or the leg raised. The knee and elbow-joints are generally semi-fixed and cannot be straightened; while the fingers, if straightened, cannot be bent, or, if bent, cannot be straightened. When the joint is fixed, the muscles of the limb often become atrophied, sometimes partially so. Chronic rheumatism sometimes disappears in a few hours or in a few days, but it may last many weeks or months, or even years.

Diagnosis.—The only diseases with which acute rheumatism, when attended with swelling and redness, can be confounded are erysipelas, gout, and *trichinous* disease, (see page 920, vol. i.) Chronic rheumatism is also often of difficult diagnosis when it attacks the intercostal spaces or diaphragm. It is apt to be confounded with pleuritic pains, or with other affections of the chest. It may also be confounded with many neuralgic affections, as well as with pleuritic diseases.

Prognosis.—The number of deaths from acute rheumatism hardly exceeds one out of every thousand deaths for all causes; whence it is manifest that this disease is seldom fatal, although one of the most common, painful, and severe diseases of this country; and perhaps the number of unsuccessful cases hardly exceeds one or two *per cent.* But although this disease is rarely immediately fatal, yet a considerable number of persons ultimately die from

diseases of the heart, apparently resulting from the action of the rheumatic poison.

Very few deaths occur from chronic rheumatism, so that the numbers that die bear but a very small proportion to those that more or less constantly suffer. The constitutional state associated with rheumatism is one in which attacks of bad health culminate at last in more or less severe paroxysms, after which the person for a time appears to have improved in health, and been better for his illness.

Causes.—If we look to the course and antecedent phenomena of rheumatism, it differs from all ordinary inflammations in the tendency it has to subside in one part and to appear in another—phenomena explicable by the laws of morbid poisons of constitutional origin, but which are opposed to all we know of the laws of ordinary inflammation. An attack of acute rheumatism is a series of febrile paroxysms during which, while one joint gets well, another becomes affected; and this is especially likely to be the case in anæmic constitutions, or those which are enfeebled from any cause. Supposing this view of the case should ultimately prove correct, it will follow that cold and wet, by lowering the vitality of parts, greatly assist or promote the action of the poison, but are not the great agents in the production of this disease. Any more express investigation into the remote or predisposing causes of rheumatism is extremely unsatisfactory. They are generally supposed to be identical with those causes which produce catarrh. Those, however, who refer catarrh to the vicissitudes of temperature only, attribute rheumatism to this cause alone; but the returns of rheumatism occurring in the different commands of our army effectually blast such an hypothesis. It is not in the coldest climates that rheumatism is most prevalent, but at those seasons and in those climates remarkable for damp and variable weather; and "thus," says Sir A. Tulloch, "we find in the mild and equable climate of the Mediterranean or the Mauritius the proportion of rheumatic affections even greater than in the inclement regions of Nova Scotia and Canada; and though some of the provinces of the Cape of Good Hope have occasionally been without rain for several years, yet rheumatism is more frequent in that command than in the West Indies, where the condition of the atmosphere is as remarkably the reverse. Exposure to wet, however, would appear to have much influence in causing that

impairment of health which induces rheumatism, for we find the returns of the navy show a considerably larger proportionate number of attacks than in the army; the number *per thousand annual mean strength* attacked in the Mediterranean fleet being 63·9; in the West India and North American station, 69; and in the South American station, 72·3. A predisposing cause of rheumatism lies not so much in the abstract degree of cold as in the range of atmospheric vicissitudes; and Dr. Haygarth has estimated that the number of persons attacked with rheumatism in summer is to those attacked in winter in the ratio of five to seven.

A very small number of children suffer from rheumatism. Out of 73 cases given by Chomel, 2 only were attacked under fifteen years—35 for the first time between fifteen and thirty—22 from thirty to forty—7 cases from forty-five to sixty—and 7 cases after sixty. At whatever age, however, rheumatism occurs, one attack, while it indicates the existing diathesis, yet does not establish a predisposition to another; and although many are always martyrs to the affection, yet a well-developed rheumatic paroxysm and a complete recovery tends to establish, under attention to diet and the prevention of exposure to cold and wet, a greater or less protection for a time; but anything which exercises a prolonged depressing influence upon the system, especially if there is at the same time a hereditary tendency to the disease, may induce the development of a severe rheumatic affection. The disease is distinctly hereditary. Dr. Fuller has traced the hereditary taint in nearly 29 *per cent.* of the cases admitted into St. George's Hospital. Men are believed to be more liable than women to rheumatism; but women, after menstruation has ceased, become more liable to rheumatism than males about the same age.

Treatment.—It seldom if ever happens that the cure of rheumatism can be safely entrusted to any single remedy; and the nature of the disease, as already indicated, points to various methods and combinations of treatment as most likely to lead to a successful issue.

Venesection, calomel combined with purgatives, and opium, are the three remedies which have been most generally made use of in the treatment of rheumatism; but many other remedies have also been and are still advocated exclusively by not a few. These are especially *vapour and hot-air baths, antimony, cin-*

chona, colchicum, guaiacum, sulphur, nitre, lemon juice, alkalies, and their salts. *Veratria* has recently been added to the list.

But as the disease, when uncomplicated, may terminate sooner or later in recovery, and may sometimes subside with marvellous rapidity under every variety of remedy, it is obvious that no sound inference can be drawn as to the success of any particular method of treatment, unless such treatment has been largely adopted in cases of similar severity—as estimated by the co-relation of pulse, respiration, and temperature (measured by thermometer)—and been attended with tolerably uniform results. Each and every plan of treatment which has therefore been hitherto proposed is regarded by the profession as unsatisfactory. (See account of a discussion upon a paper read by Mr. Dickinson to the Royal Med.-Chir. Society of London, and reported in the Medical papers of 21st June, 1862.) If in one person's hands any particular remedial course has proved efficient, it has signally failed in those of another. If at one time a remedy has proved efficacious, it has been found inert or injurious at another, under different circumstances of age, sex, constitution, and the like. These facts ought not to appear strange to those who consider the true nature of the disorder, and the variety of circumstances under which the physician may be called upon to minister to his patient's relief. Bleeding, which in the young, plethoric, and robust, may be necessary to allay excessive vascular action and cause free secretion, may in the weakly induce irritability of the heart and a consequent attack of cardiac inflammation. Opium, which in one person may prove of the greatest service in promoting free perspiration and in allaying the general irritability of the system, may in another check the biliary, "lock up" other secretions, and thus prevent the elimination of effete or deleterious matter from the system. The continued use of calomel, and constant purging by its means, which may be beneficial to one patient, by removing large quantities of unhealthy secretions, may unnecessarily exhaust the strength of another, and tend very greatly to impede recovery. And so in regard to every remedy which has been proposed: what is useful at one time may prove useless, or positively injurious, at another.

To learn how to adapt our present remedies to the exigencies of each particular case is what is now most of all required. Acute rheumatism is manifestly a highly inflammatory disease,

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but of a peculiar constitutional origin, as has been fully illustrated. The blood drawn presents a more copious layer of "buff" than most other diseases. The proportion of fibrine being greatly increased, we can hardly feel surprised that bleeding has been largely had recourse to. But although bleeding has been extensively adopted, the profession has hitherto been much divided as to the advantage derived from the practice. A careful analysis of conflicting evidence leads to the conclusion that general blood-letting is not to be recommended, and on pathological grounds it is not justifiable. No advantage is gained as to time; the loss of a large quantity of blood is worse than the disease, for it would be felt by most persons all their lives; but temporary, if any, abatement of sufferings follows its use; lastly, this mode of treatment appears to have caused in the practice of Bouillaud an unusually large number of cases of carditis—a larger number, indeed, than has been witnessed by any other person in the profession. A predisposition to cardiac inflammation is doubtless engendered by copious and repeated blood-letting: one-half the cases became so complicated after treatment by bleeding (DICKINSON). It undoubtedly increases the irritability of the heart, and consequently favours the production of cardiac complication. Repeated observation has led Dr. Fuller and others to believe that general blood-letting is only beneficial in first attacks occurring in young, robust, and otherwise healthy persons, particularly in those cases which are marked by unusual severity of their symptoms, or are unaccompanied by free perspiration. It ought at all times to be cautiously employed, and carried to a small extent only—viz., from *eight* to *twelve* ounces, according to the age and strength of the patient, the object being to *favour the action of other remedies, and to promote free secretion* by its use, rather than to arrest or cut short the disease (LATHAM, FULLER). If, therefore, perspiration is free, and remedies are absorbed, blood-letting is not to be thought of. In mild cases it is unnecessary; in the delicate, and those of weakly constitution, it is inadmissible; and in the well-expressed rheumatic diathesis, or when the disease is distinctly ascertained to be hereditary, it utterly fails in modifying the morbid action, is ill-borne by the system, and therefore should only be practised under the extremely urgent and specific conditions just mentioned (WILLAN, FORDYCE, ALISON, TODD, WATSON, FULLER, DICKINSON).

If circumstances, therefore, ever warrant its employment, it ought necessarily to take the lead of all other measures, and may be used in the young, plethoric, and robust, in whom secretion is insufficient, whose pulse is full and bounding, and whose skin is dry, and hot, and burning. A single bleeding is sufficient to relieve the excessive congestion, on which the want of secretion in a great measure depends, and which forms an obstacle to the action of those remedies on which we rely for effecting a cure. Active purgation is also to be avoided. It is injurious for three reasons,—*First*, Because it is not necessary to the cure of the patient, and, like bleeding, tends greatly to reduce his strength and protract recovery. *Second*, Because, from the nature of the complaint, the patient is quite incapable of moving, and his sufferings are aggravated, his irritability is increased, and his heart's action accelerated, by the repeated shifting of his position, which is rendered necessary by the calls of nature. And, *Third*, Because it necessarily gives rise to more or less exposure, which must be prejudicial to a person bathed in perspiration (FULLER).

The aim of purgation in rheumatism should be to obtain merely a single free evacuation every morning, after having obtained one full dejection by the following combination:—

℞. Calomelanos, gr. v.; Pulv. Jalap Co., ʒij.-ʒi.; Pulv. Zingiberis, gr. iii.-gr. v.; *misce.* This powder, taken in a little milk, will secure an abundant secretion from the glandular follicles of the intestinal mucous membrane.

The daily evacuation of the bowels is then to be maintained by mild saline purgatives, such as the *potassio tartrate of soda, sulphate and carbonate of magnesia*, taken as a draught in the morning; and preceded every second night by a Plummer's pill at bedtime, combined or not, according to circumstances, with a full dose of opium; or a grain of the watery extract of Barbadoes aloes may be found sufficient on alternate days. *Opium* may be given with the greatest advantage in the early and most painful stage of the disease occurring in adults, to the extent of *six* or *eight grains* of the powder in *twenty-four* hours, or two grains of the extract of opium may be given every night: to children, *half-grain* doses of the powder, or less, according to age, may be given every three or four hours. The bowels require to be kept open during its use; and *its influence* requires to be *closely watched.* If the urine increases in quantity, if the motions

become more healthy in appearance, and the coated tongue cleaner and less red, the influence of the opium is beneficial. It encourages sweating.

Colchicum administered alone is a dangerous agent; but its virtue as a remedy may be obtained in small doses in combination with other medicines. It may be given with small doses of *ipecacuanha, alkalies,* and *opium.* It promotes evacuation by the kidneys, and appears to exercise some unknown influence over the process of assimilation, whereby the formation of the rheumatic poison is checked. It is only in some cases, however, that it appears to be of service. It is far less efficacious in the weak and nervous than in the more robust and less easily depressed, and of less value in purely *fibrous rheumatism* than in cases where the *synovial inflammation* predominates; and in the hands of Dr. Fuller it has proved less advantageous in proportion as the fever has exceeded the articular swelling, and as the urine has been less highly charged with lithates. The operation of this remedy must under all circumstances be most carefully watched; and a daily evacuation from the bowels must be secured during its use. If the lithates disappear from the urine, if the pulse becomes weak, if faintness, nausea, or purging supervene, the *colchicum* must be at once discontinued; but till some one of these symptoms occur, *a grain* or *a grain and a half* of the *acetous extract* or *the inspissated juice,* or from *fifteen* to *twenty minims* of the *wine of colchicum,* may be safely and with advantage administered two or three times a day.

Veratria is to be used in small doses. The ordinary formula recommended is:—

Veratria and extract of opium, one grain each, to be divided into ten pills, of which two pills are to be given the first day, three the second, four the third, five the fourth, and so on, increasing one pill each day, until the condition of the pulse or the irritation of the mucous membrane compels a diminution.

The beneficial effects of *guaiacum* are obtained in those cases which are unaccompanied by perspiration, and in which the excretory organs are gently excited by the action of the remedy; but when the patient is perspiring freely, and when it neither purges nor causes diuresis, very little benefit is obtained from its use. Combined with *bitartrate of potass, sulphur,* and *rhubarb,* it constitutes the chief ingredient in a celebrated empirical formula,

well known to Army medical officers under the name of "Chelsea Pensioner," which has obtained a high reputation amongst old soldiers as a remedy for the "pains," or chronic rheumatism.

In some large hospitals, both civil and military, this remedy is in common use in the treatment of old chronic cases. Its composition is as follows:—

℞. Pulv. Guaiaci, ʒi.; Pulv. Rhei, ʒii.; Bitartr. Potassæ, Sulphur. Sublim., ā ā ʒi.; Pulveris Nucis Moschatæ, ʒii.; Mel., ℔i.; *misce bene.* Of this compound two large spoonfuls may be taken night and morning.

The general treatment originally recommended by Brocklesby (1764), and followed successfully by Macbride (1772), Basham, Fuller, Furnival, Garrod, and now by many other physicians, is that by *alkalies* and the *neutral salts, with colchicum,* a little *antimony* being sometimes added, with the occasional aid of *calomel,* used only as a purgative, to promote evacuation from the glands of the intestinal mucous membrane. Baths are never to be employed if the skin is acting freely; but if it is hot, dry, and burning, its action may be successfully stimulated by means of the vapour or hot-air bath.

If the bowels act once a day, a laxative dose of calomel and opium may now and again be prescribed, if necessary, with the view of modifying the character of the intestinal secretions. Dark-coloured and offensive stools indicate the necessity for the dose, followed by a draught of *infusion of senna,* together with half an ounce of the *potassio tartrate of soda* and *twenty minims* of the *vinum colchici,* and these should be repeated every evening and morning till healthier evacuations are obtained—*i. e.*, till the motions are light-coloured, more bilious, and less offensive.

Mercury has been recommended with the view of warding off cardiac symptoms; but when it is given so as to affect the constitution before the commencement of cardiac inflammation, it not only has no influence in preventing the disease, but, by the irritability and general depression which it occasions, appears to modify the course of the disease in a manner by no means conducive to recovery. It destroys the red blood-corpuscles, and adds to the anæmia. About one in four cases treated with mercury are liable to cardiac complication (DICKINSON).

Alkalies, or the neutral salts, may be given in combination with *colchicum,* full doses of *opium,* and a little *antimony.* They aid

the disintegration, and increase the elimination of sulphuric acid, by augmenting the alkaline condition of the blood (PARKES). The *alkalies* ought to be given largely. The patients lose their pains under their influence, and proceed rapidly to convalescence. The pulse is generally tranquillized within *forty-eight* hours from the commencement of treatment, and if in twenty-four hours the pain is lulled and the local inflammation greatly subdued, the constitution is evidently coming under the influence of the remedy.

The form in which the remedy is to be given is that of a simple *saline* or *nitre draught*, to which from two to three drachms of the *potassio tartrate of soda* may be added, with ten to fifteen minims of the *vinum colchici*, from fifteen to twenty minims of the *vinum antimonii*, and from ten to fifteen minims of the *tincture of opium*, or of Battley's sedative solution, to prevent the salt running off by the bowels. This draught is repeated for the first twelve or twenty-four hours, at intervals of three or four hours, according to the strength of the patient and the severity of the attack; and if pain is excessive, a pill containing half a grain to a grain and a half of opium, or an equivalent dose of Dover's powder, may be given once or twice daily. In the use of these remedies, constipation and narcotism are to be avoided on the one hand, and diarrhœa to be guarded against on the other (FULLER). If the saline treatment is to be used alone, then a solution of *nitrate*, *acetate*, and *bicarbonate of potash* should be given in such doses that *ten* or *twelve* drachms of the two latter salts together are taken in the twenty-four hours. Half a drachm of the *acetate*, with a drachm or a drachm and a half of the *bicarbonate*, and *ten grains of nitre*, dissolved in an ounce and a half of water and sugar, or lemonade, and given every two hours, night and day, until the joint affection and pains have begun to yield in severity, are sufficient for this purpose. Or the following:—*Nitrate of potash*, one drachm; *acetate of potash*, three drachms; *water*, eight ounces. Of this mixture one ounce for a dose ought to be repeated every two, three, or four hours, according to the urgency of the symptoms; or from twenty to sixty grains of the *bicarbonate of soda*, or of *potash*, may be given every three or four hours in half a bottle of soda or seltzer water; or in an effervescent *citrate of ammonia*, or *potash* draught (TANNER). This is the treatment which most of all seems efficient in warding off the cardiac complications; and Dr. J. J. Furnival was the first (after

Prout) to direct the attention of the profession to the use of alkaline remedies (*carbonas potassæ*) in the treatment of *Rheumatism*, and especially as a preventive of the cardiac complication (*Lancet*, 1841, p. 305). The good effects of such treatment as a preventive of the cardiac affections have been since fully demonstrated by Fuller, Garrod, Basham, Goodfellow, and others. To be effective, the remedy must be carried out with energy and perseverance, till the articular and febrile disturbance are lessened, and till an alkaline condition of the urine is established as soon as possible. *Liquor potassæ* in ʒss. doses may also be given to the extent of ʒiii. to ʒvi. in twenty-four hours (PARKES). Brocklesby is the earliest authority for the use of large doses of *nitre* in the treatment of acute rheumatism. He enjoined, for a diluting drink, water gruel boiled smooth, in each quart of which he dissolved two drachms of *nitre*, with or without sugar. He often thus prevailed on soldiers to take *ten drachms* or more of *nitre* in *twenty-four hours.*

The *alkaline treatment* of rheumatism as the basis of operations seems by far the most rational; for it has now been abundantly demonstrated that in cases of acute rheumatism there is an absolute deficiency of the saline ingredients of the blood; and while there is also a liability to fibrinous exudation, the tendency of saline remedies is to suspend the separation of fibrin (STEVENS). The treatment which has saline remedies for its basis thus contributes to restore the balance of the saline ingredients in the blood, and controls the tendency to fibrinous deposition. The progress of inflammatory action being thus retarded, time is gained for other remedies to effect the diminution of the excess of fibrin present in the blood, as well as the destruction of the rheumatic element, whatever that may be. *One, two*, or even *three* ounces of *nitre* may be taken in the twenty-four hours; but it must be very freely diluted in lemonade or in gruel. The urine passed under its influence acquires a high specific gravity, 1·026, 1·040.

In the experience of Dr. Chambers the nitre treatment is not so preservative against cardiac complications as the treatment with *bicarbonate of potash;* but his observations are not conclusive, because those treated with the latter remedy were also enveloped in blankets and flannel, so that no linen was allowed to touch the skin—a most important curative management of rheumatic cases, which cannot be over-valued. "*Bedding in blankets reduces*

by a good three-fourths the risk of inflammation of the heart run by patients in rheumatic fever, diminishes the intensity of the inflammation when it does occur, and diminishes still further the danger of death by that or any other lesion; and at the same time it does not protract the convalescence" (Chambers's *Lectures*, chiefly Clinical, p. 147).

There is some difficulty in fixing exactly the date at which the disease may be said to have yielded, or to have disappeared. Cessation from pain has sometimes been taken as the sole indication. But a morbid state of the system in rheumatism may exist after the joints are free from active pain, and even without the presence of any cardiac affection, which requires but the smallest exciting cause to bring back the articular or heart affection in all its pristine intensity. Patients in such a state, though free from pain at the time, cannot be considered rid of the disease. Dr. Garrod looks upon the following conditions, therefore, as indicating real freedom from the disease:—(1.) Absence of pain and any acute tenderness of the joints; (2.) Freedom from any active cardiac affection; (3.) Absence of marked thirst, with returning appetite; (4.) No unusual rapidity or hardness of the pulse; and I would add, a normal temperature.

External topical applications are also efficient aids in treatment. Warm fomentations are always employed with advantage; and of all applications a mixed alkaline and opiate solution, applied as a fomentation, is the most powerful in allaying the pain of rheumatic inflammation. The solution so highly recommended by Dr. Fuller for this purpose is composed of an ounce of the *carbonate of potash* dissolved in a pint of the decoction of poppies or of rose-water, to which six drachms of Battley's solution is added, or common tincture of opium, which is less expensive and equally efficient as an external application. The efficiency of salines as a local application is probably due to their influence in correcting the disordered state of the blood at the part, by preventing or destroying the aggregation of the corpuscles, and consequently their tendency to separate from the fibrine and to accumulate in the minute vessels. On this principle the application was theoretically indicated many years ago by Mr. Gulliver as useful in inflammation. *Spongio-piline* is admirably adapted for the purpose of applying locally the saline remedies. Dr. Basham recommends its application in the follow-

ing manner:—"If the hands, elbows, knees, or feet are the seat of inflammation, gloves or caps are made of the *spongio-piline* to fit these parts; if a greater extent of surface be involved, a portion of the *spongio-piline* is cut large enough to envelope the entire surface. The spongy surface of this epithem is first moistened freely with water, and any superabundant fluid squeezed from it, so that the linen or bed of the patient may not be unnecessarily wetted. *Nitrate of potash*, or the salt to be employed, *in powder*, is then freely and plentifully sprinkled over the moistened surface, or rubbed in, to secure its solution and the thorough impregnation of the epithem; it is then applied to the inflamed part, and lightly secured by a roller. Nothing further is required than once in about six hours to re-moisten the spongy surface; fresh addition of nitre is never required if sufficient quantity has been used in the first instance. The salt in powder is hence better than a saturated solution, which nurses seldom succeed in making (Basham, *Med.-Chir. Trans.*, vol. xxxii., p. 10).

In contradistinction to the principle of cure now laid down, and which has been called the method of *neutralization*, Dr. Herbert Davies, physician to the London Hospital, has recently advocated a method by *elimination* as a safe and rapid mode of combating rheumatic fever. For this purpose his treatment is *absolutely* and *entirely local*, and consists of *free blistering* only. Believing that the *virus* localizes itself for a time in the inflamed joints, and that the intensity of the local inflammation is a measure of the amount of *virus* collected, he orders blisters varying in width, but of considerable size, according to the locality, to be applied round each limb, and in close proximity to the parts inflamed. Thus he affords, through the serous discharge from the blistered surface, a ready means of exit for the *virus*. The blisters are to be applied *near to, but not upon every joint* inflamed, at the very height of the inflammatory stage, even when the local pains are the most severe and the constitutional disturbance the greatest.

The success of the plan is said to depend entirely upon the blisters being applied and allowed to remain until they have thoroughly acted. Lintseed-meal poultices subsequently applied will be found highly serviceable in promoting a sufficient flow of serum. The blisters should be put entirely round the affected limb, and when the knees are the joints which suffer, the blisters should be cut at least three inches wide.

If this method of treatment be adopted, no medicine ought to be given beyond an occasional purge, and no advantage results from combining the *alkaline* or neutralization system of treatment with that by *blisters*, or the method by local elimination. If the two methods are combined, the period of convalescence is protracted. That the poison is really thrown out by the blister method of treatment is deduced as well from the rapid and permanent relief resulting from the local treatment, as from *the neutral and even alkaline condition of the urine*, which is a usual and early result of the treatment, as well as a rapid diminution in the force and frequency of the pulse (*London Hospital Clinical Reports*).

The diet of the patient, in acute rheumatism, should be strictly limited to slops, such as arrow-root, beef tea (Liebig's *Extract of Flesh*), milk and lime-water, or milk made warm, to which a little *carbonate of soda*, *nitrate of potash*, or *bicarbonate* of potash is added, light puddings, to which sherry or brandy may be added, if depression exist; and even in many chronic cases it is desirable to limit the diet to puddings and white fish.

To obviate the great drain upon the system, it is necessary, however, that the rheumatic patient be better fed than in cases of idiopathic inflammation. Beef tea and jellies may be given, and strong coffee might also be administered frequently, on the same principle that it has been given in typhus fever by Dr. Parkes, following up the indications obtained from the physiological action of that beverage as expounded by Lehmann. (See p. 449, vol. i., and p. 8, *ante*.)

The nature and treatment of the local complication, such as *pericarditis*, will be considered subsequently; but in addition to the alkaline remedies, which have an undoubted influence in shortening the duration of the illness, the bedding in blankets, referred to at page 35, is a most important measure for preventing the cardiac affection.

In the forms of muscular rheumatism the local appliances which secure rest and warmth are those which afford most relief. In lumbago nothing is so instantaneously beneficial as strapping the back from the level of the "seat" upwards, in imbricated layers, by straps of adhesive sticking-plaster, or warm-plaster (TUFNELL).

ACUTE GOUT.

LATIN EQ., *Podagra acuta;* FRENCH EQ., *Goutte aiguë;* GERMAN EQ., *Acute Gicht;* ITALIAN EQ., *Gotta o Podagra acuta.*

Definition.—*Febrile excitement of a specific kind, attended with a specific form of non-suppurative inflammation, with considerable redness of certain joints, chiefly of the hands and feet, favoured by congenital or hereditary constitution, associated with disorder of the digestive and other internal organs, characterized especially by an affection of the joints, and especially of the first joint of the great toe—by nocturnal exacerbations and morning remissions—by vascular plethora and the presence of lithic acid, and probably also of phosphoric acid in the blood. The constitutional affection tends to culminate in a paroxysm, or "fit of the gout," at longer or shorter intervals, when various joints, textures, or parts of the body, are apt to become affected.*

Pathology.—The constitutional origin of gout may be explained in a similar manner to that of rheumatism; but the nature of the *gouty poison* appears to have been more definitely ascertained. About 1787-1793, Mr. Murray Forbes, remarking the close connection between gout and gravel, and the tendency of the disease to form concretions, ascribed gout to the presence of *Lithisiac,* or what has since been named *uric* or *lithic acid* in the blood. These concretions are liable to periodical deposition, through the medium of inflammation, in organs whose vessels are of the smallest order—for example, tendons and ligaments (*Treatise on Gravel and Gout,* pp. 78-80). About the same time, Berthollet had advanced an opinion not dissimilar with regard to the presence of *phosphoric acid.* From numerous observations this chemist concluded that *phosphoric acid* is more sparing in the urine of the gouty and the rheumatic than in that of healthy persons, and that during a paroxysm it became more abundant, and equalled the proportion found in the urine of the most healthy persons. He therefore ascribed gout to the retention and accumulation of this acid, and its diffusion through the system (*Journal de Médecine,* Juin, 1786, p. 476). The reverse of this doctrine was afterwards maintained by Richerand, who observes that, on the approach of gouty fits, the phosphoric ingredients of the urine diminish, and seem to be conveyed to the joints, to produce the arthritic concretions (CRAIGIE).

In 1848, Dr. Garrod, of London, published a paper in *The Med.-Chir. Transactions* (and he has since that time constantly directed his attention to the subject), in which he proves experimentally the statements of Forbes, and shows that the blood, in cases of gout, contains *lithic acid* in the form of *lithate of soda*, and that in cases of chronic gout with chalky deposits round the joints, *lithic acid* is *always* present in the blood and deficient in the urine, both absolutely and relatively to the other organic matters. He believes that the *acid* is always in excess in the system during gout, and constitutes a very important and almost a pathognomonic sign of gouty disease with affections of the joints. The uric acid is found to exist not only in the blood-serum, but also in the fluid effused by blisters, and in the abdominal and pericardial fluids. The abstraction of a very small amount of blood is required to discover the uric acid if it is present in quantity. From one to ten fluid drachms of the serum being taken, it is to be put into a broad and flat glass dish (not watch-glasses), about three inches in diameter, and about a third of an inch deep. Add acetic acid, of the strength of the London pharmacopœia, in the proportion of about six minims to each fluid drachm of the serum; a few bubbles of gas are generally evolved at first. When the fluids are well mixed, a very fine thread is introduced, consisting of from one to three ultimate fibres, from a piece of unwashed linen fabric, about an inch in length, which should be depressed by means of a glass rod. After resting for from eighteen to forty-eight hours, depending on the warmth (temperature at or below 70°) and dryness of the atmosphere, the uric acid will crystallize upon the thread. To observe this, a microscope must be used with a linear magnifying power not below 60.

When gout has become fully developed, and has assumed its specific inflammatory character, it produces all the forms of articular inflammation which have been described in rheumatism, and these inflammations attack nearly the same parts, as the bones, cartilages, synovial membranes, bursæ, ligaments, muscles, tendons, and aponeuroses. These inflammations have little to distinguish them from rheumatism, except the singular pathological phenomenon of a tendency to the deposition of the urate of soda—a discovery we owe to the late Dr. Wollaston.

Occasionally the urate of soda appears to be nearly the sole secretion from the affected part, nothing being seen on the poultice

or fomentation cloth applied to the part but this salt in a more or less fluid state. It is secreted from the joints of the toes or fingers, and probably from all their different tissues. Portal gives a case in which the articulations of both hands presented deposits of urate of soda, both within the capsules of the joints and externally among the ligaments, while the tendons of the extensor muscles of the fingers were almost destroyed. In the Hunterian Museum of Glasgow there is a finger from a gouty hand, with a joint opened and bent upon itself, showing not only a deposition of the salt, but an erosion of the cartilages; also another, in which the joint is full of this peculiar secretion, and a third in which the joint is everywhere invested with it. In the Museum of St. Thomas's Hospital there is a specimen in which the femoral cartilage of the knee-joint is coated with it, as if smeared over with plaster of Paris; and another in which it is deposited on the ligaments of the extensors of the hand. Guibert gives a case in which the metatarsal articulation of the great toe was surrounded by urate of soda of a rose tint, and on the inside of the foot, in the cellular tissue, was an abscess containing urate of soda, making its way to the surface. On opening the joint the same substance was found, and on cutting through the tendons, pieces of urate of soda were distinctly seen between the fibres. Simon gives an account of a gouty skeleton, of which the bones were completely anchylosed. In the preparations of diseased joints in the Museum of the Army Medical School at Netley (and described by Mr. Gulliver in *The Edin. Med. and Surgical Journal*, vol. xlviii.), the material is said to be deposited outside the joint in the cellular tissue, exterior to the periosteum and articulation capsules. Similar dissections are described by Watson, Moore, and Parry. The bones affected in cases of gout have been found swollen, and sometimes so soft as to have been easily cut by the scalpel.

The urate of soda is deposited first in a white fluid state, like a mixture of chalk and water; after a time this fluid portion becomes absorbed, leaving concretions consisting of little more than bundles of crystals of urate of soda, and often in such quantities that a poultice, though applied several times a day, has been covered with them, and that for several days together. The concretions afterwards harden, and form what, from their colour and appearance, have been termed *chalk-stones*, *tophi*, or *tophaceous*

deposits, often superficial and of considerable size, so that, when the skin has ulcerated, a patient has been said in one instance to have scored his game of cribbage with his knuckle, and in another to have written on the table with the *chalk* penetrating through the ulcerated tips of his fingers. Not unfrequently, after a time, deposits of *phosphate* and *carbonate of lime* ensue in and around these semi-fluid concretions; but it is not believed that such deposits ever replace the *urate of soda* in gouty subjects.

Although these specific exudations and morbid elements in the blood are but indications of the gouty condition, they nevertheless confirm the belief again gaining ground, which teaches the ancient humoral doctrine, that the phenomena of gout are induced by some peccant matter (probably uric acid) which, through malassimilation of food, or of food and drinks of particular kinds, combined sometimes with excessive labour of body as well as of mind, becomes inbred in the constitution, and which it is the business of the paroxysm of gout to eliminate.

The natural history of the disease shows—(1.) That there is a disposition or tendency in the morphological relations between the solids and fluids of the whole system to develop some specific constitutional poison, which betrays itself by certain constant effects at periodical intervals, although these may be irregular. (2.) That these local effects are prone to develop themselves in the joints of the extremities, or to express themselves by symptoms of a particular kind in the internal organs, and in various textures of the body.

Dr. Graves has given the most interesting illustration of these propositions in his clinical lectures; and especially of the development of peculiar local affections in connection with gout. For example, the occurrence of—(1.) "Fugitive pains," or twitches which suddenly attack persons of gouty habit. The pain is, no doubt, due to congestion. Sometimes the congestion is more lasting, as in the lobes and cartilages of the ear, and where, as Dr. Garrod shows, concretions sometimes occur. (2.) A singular affection of the teeth, which consists in an insuperable desire to grind them, is noticed by Graves. (3.) The occurrence of *tic-douloureux* of the several branches of the fifth pair. (4.) Daily paroxysms of intense heat of the nose, which continues for three or four hours, the part becoming first of a bright and then of a purplish red colour, spreading over the upper portion of the cheek,

(5.) The occurrence of *gouty sciatica*, in which the specific inflammation affects the trunk of the sciatic nerve, and which, extending by the neurilemma of the nerve, may in process of time extend to the spinal marrow and its investments, and give rise to derangements of the latter, terminating in ramollissement and structural degeneration. This complication of gout was first decidedly pointed out by Dr. Graves. These affections are always greatest when the stomach is most deranged.

It is now generally believed that gout is hereditary; and in many instances it is so, whether the intemperate habits of ancestors are followed out, or whether the mode of living be abstemious. In some families it attacks only alternate generations, following what has been called "the law of *atavism*." The power of hereditary transmission to induce gout has been illustrated in a most interesting way by Mr. Spencer Wells in his treatise on this disease. He shows that the children of a patient born prior to the development of gout in their parents were free from this affection in after-life, but that those children born subsequently to the development of gout in the same parents became afterwards gouty. The potent influence of hereditary predisposition in regard to gout is now known to betray itself even amongst some of the labouring classes, and in the upper classes in a still greater proportion. Dr. Garrod instances the case of a gouty gentleman who is able to trace the disease in his family for four hundred years, and in which the eldest son has invariably inherited, *with the estates*, gout of the worst form and developed at an early age. On the other hand, again, it is certain, and consistent with the constitutional origin of this disease, that an unusually large proportion of non-hereditary cases are met with among the indolent and luxurious inhabitants of large metropolitan towns.

A flattering hallucination has been transmitted traditionally, hereditarily, and historically, which connects the gouty diathesis with high mental development. But the conditions for the constitutional development of this disease must either be more common, or physicians must be getting more acute, for eminent and observant men are now inclined to discard the doctrine which teaches the noble origin of gout, and its necessary association with high mental development. The disease is now certainly common and plebeian, as well as aristocratic. It may have been, in the

days of Sydenham, that the gouty patients of a physician were to be found amongst "*magni reges, dynastæ exercituum, classiumque duces, philosophi, aliique his similes.*" Now-a-days it is no less certain that the physician, in London at least, must pay his visits and prescribe for gout amongst "the London labour," as well as among "the London poor," and his list will number "coal-heavers, bakers, brewers, draymen, house painters, butchers, innkeepers, publicans, butlers, coachmen, and porters in wealthy families especially" (COPLAND, BUDD, GARROD, TODD). A gouty conformation has been accurately described by Sydenham, Frank, Scudamore, and others; and one of the constant characters of such a conformation is former or existing corpulence; and it is now known as consistent with the constitutional origin of this disease that the disposition to develop gout may be brought about by abnormal habits of existence; and if the hereditary predisposition is present, the conditions for developing the latent diathesis are more easily made efficient. All are agreed as to the influence of full living, with the free and habitual use of wine, and especially now as to the influence of what may be called gross living, great and indiscriminate consumption of animal and vegetable food, with indulgence in beer and malt liquors generally (BUDD and TODD); and it appears, both from the observations of Sydenham, Craigie, Wm. Budd, Todd, and Wood, that it is not so much the particular variety of alcoholic drink used, as the mode and extent of the use, which tends to develop the gouty state; but it is believed that, of all wines in common use, those of the Rhine vintages are the least productive of gout. They are said to contain less alcohol than any of the Southern wines, and less than those of Portugal, Spain, Sicily, Cyprus, and Madeira. The influence of malt liquors is especially obvious in those examples of gout which occur in the lower classes. "There is a body of men," writes Dr. Wm. Budd, "employed on the Thames, whose occupation is to raise ballast from the bottom of the river. As this can be done only when the tide is ebbing, their hours of labour are regulated by that circumstance, and vary through every period of the *night* and *day*. They work under great exposure to inclemencies of the weather; their occupation requires great bodily exertion, occasioning profuse sweating and much exhaustion. Each man drinks from *two* to *three gallons of porter daily*, and generally a considerable quantity of spirits besides. *Gout is remarkably*

frequent among them." Such an instance contrasts strongly with the prophylactic influence of corporal labour displayed amongst other classes of the people who do not *labour under the influence of gallons* of malt liquor; and it is interesting to notice that in the non-beer-drinking countries the lower classes escape. Gout is rarely seen in Scotland.

A belief in the prophylactic virtue of labour and moderate living probably instigated the abrupt reply of Abernethy to the question, "What is the cure for gout?" when he said, "Live on sixpence a day, and earn it." The disease very rarely occurs before puberty, but is seen in both sexes under twenty. Many cases occur between twenty and thirty, but the period of greatest liability is perhaps from thirty to fifty. After this the chances of exemption increase with age, probably from the more temperate habits of advanced life. But at whatever age gout may appear, every attack establishes a greater disposition to another. Women often suffer greatly from gout, but not in an equal degree with men. Gout is never developed without being associated with indigestion, or as a sequence of impaired digestion from some error in diet or drink; and of all wines, Port wines and Burgundy are most apt to induce such kind of indigestion as accompanies or precedes an attack of gout. The immediately exciting causes of this disease are very much similar to those of rheumatism. In thus describing the *pathology* of gout, the causes and constitutional source of the disease have been sufficiently indicated.

The varieties of this disease, in addition to the acute form, are:—(2.) *Chronic Gout—a persistent constitutional affection, characterized by stiffness and swelling of various joints, with deposits of lithate of soda;* (3.) *Gouty Synovitis.*

Symptoms.—These vary according as the disease attacks the joints, the stomach, or the intestinal canal, but the proportionate frequency with which these different parts are attacked is not yet ascertained. It may be acute or chronic, and when the viscera are affected, it has been termed irregular, retrocedent, or misplaced gout. Sydenham was himself a great sufferer from this affection, and laboured under it for more than thirty-four years. He thus describes an acute attack or fit:—

"It comes on a sudden towards the close of January or beginning of February, giving scarce any sign of its approach, except that the patient

has been afflicted for some weeks before with a bad digestion, crudities of the stomach, and much flatulency and heaviness, which gradually increase till at length the fit begins. The patient goes to bed, and sleeps quietly till about two in the morning, when he is awakened by a pain, which usually seizes the great toe, but sometimes the heel, the calf of the leg, or the ankle. The pain resembles that of a dislocated bone, and is attended with a sensation as if water just warm were poured upon the member; and these symptoms are immediately succeeded by a chilliness, shivering, and slight fever. The chilliness and shivering abate in proportion as the pain increases, which is mild in the beginning, but gradually becomes more violent every hour, and comes to its height towards evening, adapting itself to the numerous bones of the tarsus and metatarsus, the ligaments whereof it affects so as sometimes to resemble a tension or laceration of those ligaments, sometimes the gnawing of a dog, and sometimes a weight and coarctation or contraction of the membranes of the parts affected, which become so exquisitely painful as not to endure the weight of the clothes, nor the shaking of the room from a person walking quickly therein; and hence the night is not only passed in pain, but likewise with a restless removal of the part affected from one place to another, and a continual change of its posture. Nor does the perpetual restlessness of the whole body, which always accompanies the fit, especially in the beginning, fall short of the agitation of the gouty limb. Hence numberless fruitless endeavours are used to ease the pain by continually changing the situation of the body and the part affected, which notwithstanding abates not till two or three in the morning—that is, till after twenty-four hours from the first approach of the fit. Being now in a sweat, he falls asleep, and upon waking finds the pain much abated, and the part affected to be swelled; whereas before only a remarkable swelling of the veins thereof appeared, as is usual in all gouty fits.

"The next day, or perhaps two or three days afterwards, the part affected will be somewhat pained, and the pain increases towards the evening, and remits towards break of day; and what we call a fit of the gout is made up of a number of these small fits. At length the patient recovers, which, in strong constitutions, and such as seldom have the gout, often happens in fourteen days; and in the aged, and in those who have frequent returns of the disease, in two months; but in such as are more debilitated, either with age or the long duration of the distemper, it does not go off till summer advances."

In aggravated cases it attacks both feet, the hands, wrists, elbows, knees, and other parts; sometimes bending the fingers crooked and motionless, and at length "forms stony concretions

in the ligaments of the joints, which, destroying both the scarf skin and the skin of the joints, stones not unlike chalk or crabs' eyes come in sight, and may be picked out with a needle. Sometimes the morbific matter is thrown upon the elbows, and occasions a whitish swelling almost as big as an egg."

During the first fourteen days the urine is high-coloured, and after separation lets fall a kind of red gravelly sediment, and not above a third part of the fluids taken is voided by urine during the febrile paroxysm, the bowels also being generally constipated during this time. The fit is accompanied throughout with loss of appetite and chilliness of the whole body towards the evening.

The urea is probably not below the normal standard, its elimination not appearing to be interfered with during the paroxysm (GARROD, PARKES). The elimination of uric acid by the urine is impeded during the paroxysm; but it exists in large amount in the blood. It has also been suggested, as a hint for further inquiry, that the substances which, in a healthy state, would furnish urea, are converted into uric acid in gout (GAIRDNER). The phosphoric acid is also greatly lessened, and its retention is probably as common as that of the uric acid. Albumen is not uncommon in small quantities, but its occurrence is generally temporary; and if it is persistent, there is reason to suspect the chronic disease of the kidney which is produced by gout (TODD); and casts without albumen may be found in the urine sediments. After the paroxysm the water is usually copious; and the uric acid increases as the fit is passing off, just after the paroxysm. Before the paroxysm of gout the urine is found to be very deficient in solids, especially in urea, uric acid, extractives, and phosphate of lime. There is, in fact, a diminution of all the chief ingredients before the paroxysm; during the paroxysm there is insufficient elimination of uric and phosphoric acids, while the urea and sulphuric acid are in sufficient amount; and after the paroxysm the elimination again increases, (PARKES, l. c.)

When the fit is going off, a violent itching seizes the foot, especially between the toes, and the skin peels off.

When the disease has become chronic, or, as Sydenham terms it, inveterate, "after yawning, especially in the morning, the ligaments of the bones of the metatarsus are violently stretched, and seem to be squeezed with great force, as if with a strong hand. And sometimes, though no yawning has preceded, when the

patient has disposed himself to sleep he feels a blow on a sudden, as if the metatarsus were breaking in pieces, by a large stick, so that he wakes crying out with pain. The tendons of the muscles of the tibiæ are sometimes seized with so sharp and violent a convulsion or cramp, that if the pain it occasions were to last only a short time it could not be borne with patience."

After many racking pains the succeeding paroxysms become less painful, when, "instead of the usual external pain, a certain sickness, a pain in the belly, a spontaneous lassitude, and sometimes a tendency to diarrhœa succeeds." Besides the pain and sickness, the patient becomes lame, and almost incapable of motion, and is perhaps obliged to be wheeled or carried from room to room; and he is not only reduced to this helpless condition, but, to complete his misery, his mind sympathizes with his body. "For every paroxysm may be justly termed a fit of anger, the rational faculties being so enervated by the weakness of the body as to be disordered on every trifling occasion, whence the patient becomes as troublesome to others as he is to himself."

Another form of chronic gout is known as *atonic gout*, when the joints enlarge, and the tissues and ligaments become thickened, and the seat of various effusion, so as often to distend and even to dislocate the bones; and yet, if the patient be kept quiet, he suffers no pain. The general symptoms, however, are most distressing. The patient suffers from loss of appetite, indigestion, sickness, nausea, flatulence, acid eructations, pains of the stomach, cramps in the legs and in various parts of the body; also great dejection of spirits, vertigo, palpitation, fainting, asthma, and also, perhaps, from stone or gravel. These affections, in some form or other, continue with occasional intervals during the remaining life of the patient, who believes that he has the gout *flying* about him, and that he should be well if he had a regular fit.

In the course of this disease there may be a metastasis to the stomach or other part, and the affection is then termed "*retrocedent gout*," the pain in the joints being trifling, or having entirely subsided. The term is "*applied to cases of gout in which some internal organ becomes affected on the disappearance of the disease from the joints, and should be referred to acute or chronic gout.*" When the metastasis is to the stomach or intestines, it may be either of a spasmodic or inflammatory character. The spasmodic is the most frequent. The patient is

seized with violent pains in the stomach, with faintness, coldness of the extremities, and a quick, small, and scarcely perceptible pulse, accompanied with much flatulence, acidity, or vomiting. If, on the contrary, the attack be of an inflammatory character, the pain is perhaps equally great, but is increased on pressure, and there is more re-action, some fever, a fuller pulse, with vomiting, and perhaps obstinate constipation. The duration of these attacks is short, as the patient must be quickly relieved or quickly perish. Besides metastasis to the stomach and intestines, this retrocedence may take place to other parts, as to the testicle, bladder, rectum, or to the head; and in the latter case the patient may die apoplectic. The transition of the gouty virus is often marked by a pain shooting along the nerve, as sudden and as rapid as a galvanic shock, and so violent as to have been compared to stabbing with a knife. Besides being thus a migratory disease from part to part, gout often alternates with other chronic diseases, such as *asthma* and *rheumatism*, and may co-exist with them.

The functions of digestion, and especially the hepatic and urinary secretion, are much deranged in all cases of gouty paroxysms. Besides loss of appetite, flatulence, heartburn, stomach-ache or colicky pains prevail, the tongue is loaded, the bowels are bound, and air, with impacted fæces, distends the intestines, especially in the epigastric and umbilical regions. The hypochondriac regions, especially the right, are the seat of painful tension and uneasiness. The first alvine dejections are generally solid and dark-coloured, not unfrequently very fetid; and in some instances large quantities of dark-coloured excrement are brought away.

The urine, when scanty and of a deep red colour, is voided with pain and scalding along the urethra. The sediment already mentioned, and soluble in water, is rose-coloured or lateritious, and is deposited during the whole course of the attack, and its appearance is not confined to the close or subsidence of the febrile symptoms, though at that time it is more abundant. It consists of urate of soda, the phosphoric salts, and urea mixed in various proportions. When dyspeptic symptoms are associated with feebleness, a whitish magnesia-like powder, consisting chiefly of the phosphates, is deposited, or alternates with the other deposits.

When the paroxysm of gout has taken place, and terminated in the manner described, the patient appears to enjoy better health

than formerly. The appetite is good, the mind more cheerful and active, the body more agile, and the patient is delivered from many feelings of languor and oppression with which he had previously been afflicted. In this state he may remain for two or three seasons without being conscious of any complaint or symptom which would indicate a return of the disorder. In the course of time, however, generally about the same season of the year, he begins to be sensible of the presence of some of his former feelings, and at length a fit takes place much in the same manner as it did on the first occasion. This second paroxysm is, in some instances, shorter and less violent; in others it is accompanied with various circumstances which show some deviation from the first attack. But whatever be the mode or duration of its attack, another succeeds after a less lengthened interval; in some cases, the same year in the autumn—in others, next year in the spring or summer. In general the intervals are shorter the younger the patient. The most common, perhaps, is the biennial or triennial attack for the space of eight or ten years; then the attacks are annual, then twice in the year; and in some severe cases the attacks are so frequent that the patient can scarcely be said to be free from gout the whole year round. Much in all this depends on the habits and constitution of the individual. The disease tends to acquire a chronic character, and rarely quits the patient till it destroys him, either by complete lameness, helplessness, and debility, or by attacking the heart or the brain (CRAIGIE).

Diagnosis.—The diagnosis between gout and rheumatism is often exceedingly difficult, so much so that nosologists have described with perfect pathological correctness a hybrid disease, and named it "rheumatic gout." Mr. Hunter warmly opposed this compound appellation, as many have since done. Hunter's opinion was founded on the belief that no two distinct diseases, or even distinct diatheses, can co-exist in the same constitution—a belief which must now be admitted to be incorrect. (See vol. i., pp. 137, 201.) We must doubtless, therefore, recognize such a hybrid disease as Craigie, Wood, Spencer Wells, and Fuller have described, depending on the influence of the combined cachexia of gout and rheumatism.

Cases of chronic pain, with stiffness and swelling of various joints, are thus far cases of chronic rheumatism; but when they

are attended with deposits of lithate of soda, such cases are directed by the College of Physicians to be returned as cases of "*chronic gout;*" and those in which there is marked distortion, as cases of "*chronic osteo-arthritis*"—a disease which may be defined as follows:—"*An affection characterized by pain, stiffness and deformity of one or more of the joints, associated with deposition of new bone around them.*" The disease is also named "*chronic rheumatic arthritis.*"

Prognosis.—Every assurance office objects to a gouty person as liable to a disease which tends to shorten life from the wear and tear of the constitution it occasions. The objection is unquestionably well founded; for although a few persons may reach advanced age notwithstanding repeated attacks of gout, yet many die prematurely from this affection, or from asthma, disease of the heart, apoplexy, or from the accidents to which helplessness and debility render the patient liable.

Treatment.—Seeing that the disease is clearly of constitutional origin, its treatment resolves itself into—(1.) The selection and administration of those remedies which shall tend to subdue, control, or eradicate the latent disposition, constitutional tendency, or gouty diathesis; (2.) The adoption of such means as may be safely used to modify the severity of, or shorten, the paroxysm. The paroxysm must be interfered with cautiously. It is the means which nature takes to rid the constitution of the *materies morbi*, and which it undoubtedly relieves for a time, if allowed to run its course. The removal of the paroxysm does not necessarily remove the constitutional diathesis.

As to any local treatment during the fit, Sydenham writes, "If outward applications be required to ease the pain of the gout, I know of none, though I have tried abundance both on myself and others, and I have laid aside the use of topical remedies for many years." It is generally admitted that cold is dangerous, while warmth is productive of little relief. In some instances the urate of soda is deposited in such quantity that the skin ulcerates, and the salt is discharged in considerable abundance in a fluid state. It might appear the right practice to apply a poultice and encourage the discharge, in order that, by its entire removal, the joint might be saved. This, however, is by some considered dangerous practice, for the discharge is so debilitating that patients are said to have sunk under this mode of treatment.

It is much safer to wait till the chalk-stone becomes concrete, and then operate, by the smallest possible incision, for its removal. With respect to the use of cold water, the practice is as old as Harvey, and subsequently it has been adopted and abandoned by many practitioners. Dr. Parry had at one time two patients who attempted to cut short the fit by plunging their feet in cold water. The relief was instant, but in a few hours both were dead of apoplexy. The fatal result of this remedy in Sir Francis Burdett's case is another instance in point.

"A gentleman," writes Dr. Wood, "contrary to the advice of his physician, and anxious for speedy relief, ordered a bucket of water to be taken into his chamber at bedtime, with the view of employing it in this way. In the morning he was found dead in bed."

The "bootikins" of Horace Walpole, so strongly recommended and given away by him to all his gouty friends, seem to have been merely a fine bandage applied moist and firmly over the limb, and then a roller of oiled silk over it, giving moist warmth like a poultice.

A few leeches have been recommended to be applied to the part with great caution, if the inflammation is unusually violent; but Dr. Garrod is of opinion that in no case are they likely to prove efficacious, and their use may be attended with injurious consequences. *Warm* anodyne lotions or fomentations may be used, and the part afterwards lightly covered or encased in flannel or fine wool, while the limb is at the same time kept elevated. Dr. Wood uses a *warm* mixture of *tincture of camphor* with milk, applied by means of linen compresses, and frequently renewed. *Tincture of aconite* may be similarly applied (*f*ʒiss. to *f*ʒiv. of milk). *Blisters* have been recommended, and are of most advantage in asthenic chronic cases, when the inflammation has a tendency to linger in the articulations, and to cause liquid effusion. In the early fits of sthenic gout they are unnecessary; and are contra-indicated in advanced gout, when the kidneys have become impaired, and also in cases of extreme gouty deposits (GARROD). As a general rule, however, the less that is done to the *local affection* the better. When the pain is very intense, relief may be given by the application of *a solution of atropine*, made by dissolving from *two to three grains of the alkaloid in a weak mixture of spirits and water*, and applying it to the

inflamed joint by means of compresses of lint, preventing evaporation by a covering of oil-silk (GARROD).

In the general treatment of gout, bleeding is now generally restricted to two methods, namely—(1.) By leeches to the part where the inflammation rises so high, or is so chronic, as to threaten the patient with the permanent loss of the use of some joint; and to cases of metastasis of the disease to the stomach or other internal organ, when leeches are absolutely necessary; (2.) By general blood-letting.

The following rules are laid down by Dr. Garrod as to the use of bleeding in gouty cases:—(1.) Never bleed with the idea of directly subduing gouty inflammation; (2.) Never bleed in advanced gout, or when the constitution is much weakened; (3.) If bleeding be required in order to relieve general or local plethora, abstract only as much as will effect that object, remembering that further depletion tends greatly to aggravate the disease and prolong its duration. Blood-letting produces a decided sedative action on the heart and other parts of the circulating system, and it has a most powerful influence upon the progress of gouty inflammation—an influence not merely limited to the removal of gout when it attacks the joints, but also of great efficacy in its marked and irregular forms, in the ophthalmia of gouty habits, in gouty bronchitis, and in headaches connected with the gouty diathesis (SIR H. HOLLAND, GARROD).

Sydenham, who was as great an enemy to purging as he was to bleeding, says,—"I am abundantly convinced, from much experience, that purging, either with mild or strong cathartics, whether used during the fit or in its declension, or in a perfect intermission or healthy state," . . . "endangers the life of the patient by hurrying on the disease to the viscera, which were quite safe before." The objection taken by Sydenham to purgatives was quite valid against those in use in his day, which were of the most drastic kind; but it may be laid down as a rule, that neutral salts are not only safe but efficient in relieving gout, though perhaps not to be depended on alone for its cure. The theory on which they are prescribed is, that the alkaline base of the neutral salt is absorbed, and combines with the insoluble urates deposited in the joints, forming a soluble sub-urate, which can readily be absorbed; and, again, more alkali being sent to the kidney, that organ is enabled to remove more uric acid, in a soluble state, from

the system than under ordinary circumstances. The salts most in use are the *sulphates of magnesia* or *of soda*, and especially the former; and half a drachm to a drachm should be given every eight, six, or four hours, according to the state of the bowels and the acuteness of the symptoms. It is also necessary to afford some relief to the patient from his excessive suffering. With that view an anodyne should be added, such as the *tincture of hyoscyamus*, *syrup of poppies*, or *some preparation of opium*. This method of treatment relieves the patient and shortens the paroxysm; but when the relief is complete, it should be abandoned, for sometimes a paroxysm of gout will return even under its use.

Colchicum or meadow-saffron was long ago introduced as a specific in gout, of which the once popular "*eau médecinale*" was supposed to be a preparation. *Colchicum* is still, however, used, and is valuable for its purgative qualities; and in some cases it seems to be almost specific in its effects, and may be given as an extract or tincture, or as a wine, combined with some form of saline draught. Its mode of action is unknown. It very generally promotes secretion from the skin and kidneys; but it is useful even when it does not exercise any such physiological action. The quantity of uric acid and urea in the urine is said by some to be increased during its use (CHELIUS). Dr. Graves makes an opposite statement; and Dr. Garrod proves conclusively that colchicum does *not increase* the amount of uric acid. Dr. Laycock suggests that it may have a sedative effect on the vital actions going on in the tissues themselves, and so may arrest the formation of the gout poison.

The wine of the root of *colchicum* is generally the form preferred, *fifteen to thirty minims being given every four, six, or eight hours*, and this remedy ought to be continued for some time in reduced doses, after all symptoms of gout have disappeared (BUDD). The bowels ought to have been freely moved before *colchicum* is given; and a full dose having been given at first, much smaller doses may be continued, as from ten to twenty minims two or three times a day, in Seltzer or Vichy water, or in other alkaline solutions, and combined with *Iodide of Potassium*, carefully watching its effects on the pulse, and never allowing sickness or depression to ensue.

Scudamore's mixture of *colchicum*, *magnesia*, and *sulphate of magnesia*, is said to be an excellent purgative in gout, when a

purgative is required. Although Dr. Garrod has shown that purging is not necessary to the action of colchicum; yet, as there are many who believe that the action of colchicum is promoted by its combination with laxative remedies, Dr. Wood is in the habit of using it in the following formula in a draught:—

℞. Magnesiæ, ʒss.; Magnes. Sulphat., ʒss.; Vin. Colchici. rad., ♏xx.; Aquæ Fluv., vel Aq. Acid. Carbon., *f* ʒiss.

Mercury, in the form of "blue pill," or in the form of the "compound calomel pill" (*Pil. Plummeri*), followed by the draught just written, is useful where it is desired to act upon the intestinal secretions. But mercury in any form must not be given if the urine contains albumen. If mere constipation is to be got rid of, *rhubarb pill, colocynth and scammony pill,* or *podophyllin,* may be advantageously used. The iodide of potassium has been much recommended by Mr. Spencer Wells. Alkaline remedies are of much value in the treatment of the paroxysms of the joint affection, and may be prescribed in the form of the *bicarbonate* or of the *citrate* or *acetate* of potash. Dr. Garrod prefers the *bicarbonate,* and Dr. Parkes has shown that it increases the elimination of uric acid and organic solids by the urine (Parkes *On the Urine,* p. 298). Much benefit is also derived from the continuous administration of salines in small doses, repeated two or three times a day, in a *very* dilute form, and always on an empty or nearly empty stomach, and some little while before food (Garrod).

If acute gout should have "retroceded," as it is called, and the stomach or intestinal canal be inflamed, *leeches* should be applied to the abdomen or epigastrium, followed by a poultice, while the *neutral salts,* with the *tincture of hyoscyamus,* should be given at least every four or six hours. It is very rare that more active medicines are necessary.

In chronic gout the treatment is the same; but in *atonic* gout some light tonic medicine may be added, as *five* to *ten grains* of the *citrate of iron.* A large number of chronic cases, however, though the general health is improved by this treatment, are often altogether unrelieved as to the local symptoms, and are often quite unable to assist themselves. In these instances the turpentines appear to be beneficial, as *spruce beer,* the *Canadian balsam;* or one drachm of the *oil of turpentine* may be taken in

an effervescing draught once or twice a day. Sydenham's method of treatment by *manna* may also be tried.

If the chronic or *atonic* gout should become retrocedent, and the stomach and intestinal canal be the seat of the spasmodic form of the disease, Sydenham strongly recommends that laudanum should be given; but perhaps the following draught is more efficacious, namely:—℞. *Aquæ Camphoræ,* ʒx.; *Sp. Ætheris Sulphurici,* ʒi.; *Sulphatis Magnesiæ,* ʒss. It will remove from the stomach any undigested matter which may remain as an irritating cause. This should be given every hour till the patient is relieved; and while it is being prepared, hot brandy and water should be freely administered, or, the *spiritus ammoniæ aromaticus,* in doses of sixty minims, and hot cloths applied to the abdomen, as well as hot bottles to the feet.

Sydenham recommends, from experience in his own case, large doses of *manna* in all cases of what he terms "bloody urine."

As indiscriminate feeding appears to have a great influence in the production of gout, so we expect the regulation of diet should have great influence in its removal. During the fit the diet should consist of slops and light puddings, and afterwards white fish, till the paroxysm has terminated. This disease is so distressing that many persons are inclined to diet themselves with great strictness during the interval. Sydenham says that a milk diet, or drinking milk as it comes from the cow, or boiled, without adding anything to it, except perhaps a piece of bread once a day, had been much used for twenty years past in his time, and had done much service to gouty patients. But on quitting it, and returning to the mildest and tenderest diet of other persons, gout has immediately revived; and he adds that many cannot bear this regimen. An entirely water regimen he considers hurtful. The most digestible meats, such as mutton, well-kept beef and poultry, with the white kinds of fish, as codfish, sole, and whiting, may be eaten; but salmon, veal, and pork are to be avoided, as well as cheese, salads, highly seasoned dishes, and rich sauces, or other "elaborate preparations on the part of the cook." If alcohol in any form is required, it may be taken in the form of a little weak brandy, gin, or whisky and water, or pure sherry, like Amontilado, or Manzanilla. Ports, Burgundy, and sweet wines must be avoided; but wines of the Rhine vintages may be taken, if they do not contain a large per centage of alcohol. All of these spirits ought to be taken much diluted with seltzer or soda-

water. His recommendations are, that we should be early to bed, keep the mind free from all disquietude, live with the greatest moderation, clothe ourselves warmly, and ride on horseback. When exercise cannot be taken, friction over the surface of the body is exceedingly useful. The patient should be rubbed down with a flesh-brush once or twice a day, just as a horse is groomed.

One other point with regard to the treatment of the patient during the fit is, that if it be necessary to move him, either on account of his restlessness or other cause, this should be done with great care and tenderness by the attendants; for although the pain may be latent while the parts are quiet, yet the least shock often causes the most excruciating agony.

Several mineral springs have obtained reputation in the treatment of gout; and Dr. Garrod lays down the following general rules as a guide to the use of them:—

1. Their use should be prohibited when there is much structural disease in any important organ, especially in the heart or kidneys; and even when organic mischief is slight, the greatest caution in their use is necessary.

2. They are to be avoided when an acute attack is either present or threatening.

3. The particular mineral water must be selected according to the nature of the individual case: for the robust, and those of full habit, the alkaline saline springs should be chosen; when torpidity of the bowels predominates, the purgative waters should be used; when the skin is inactive, the sulphur springs may be used; and when much debility prevails, or an atonic state exists, then the more simple thermal springs may be prescribed.

The irritable state of mind of the patient during the paroxysm has been mentioned; and it is well known that slight moral causes will often produce a fit, while powerful emotions have sometimes cured one. It is quite essential, therefore, that the minds of gouty patients should be kept as tranquil as possible, both for their own sakes as well as for the comfort of others.

ANÆMIA.

LATIN EQ., *Anœmia;* FRENCH EQ., *Anémie;* GERMAN EQ., *Anaemie*—Syn., *Blutarmuth, Wassersucht;* ITALIAN EQ., *Anemia, Idropisia generale.*

Definition.—*A special morbid state in which there is either a relative diminution of the mass of blood* (ANDRAL), *with the general composition of the blood differing from the normal stand-*

ard; or in which the mass of blood is diminished, and the liquor sanguinis is watery, poor in albumen, and containing an excess of salts. These conditions, co-existing with relative deficiency of the red blood-corpuscles (VOGEL), *and a diminution of the urine-pigment* (PARKES), *constitute anæmia.*

Pathology.—The term *anæmia* literally means absolute *deficiency of blood*—a condition of existence obviously not possible. A diminution in the quantity of blood, with an alteration in its composition, almost never occurs alone, but is generally a morbid state resulting from many exhausting morbid processes peculiar to such wasting constitutional diseases as tuberculosis and cancer. In many of these diseases the blood-mass is evidently diminished. We have indications of this diminution in the small pulse, in the pale bloodless appearance of the countenance and surface of the body generally, especially seen in the lips and gums, and in the small blue collapsed veins, particularly obvious by contrast on the pallid skin. In such cases one would never think of drawing blood to know whether or not its constitution was changed; but in cases where the opportunities for examination have occurred, the blood-corpuscles have almost always been found relatively diminished.

The result of this morbid condition of the blood chiefly betrays itself—(1.) Upon the *vascular system* generally; and (2.) Upon the *metamorphoses of tissues.*

The blood-vessels contract in proportion to the diminution of the blood-mass. The *arteries* contract generally; and the pulse, whenever it can be felt, is found to have become small and tense. The *capillaries* also contract; the skin and mucous membranes becoming pallid and comparatively bloodless. The *heart's* action in extreme cases becomes irregular, and the whole circulation generally is disturbed.

As regards the metamorphoses of tissues the muscles and the nervous system appear to suffer first; debility and prostration, both bodily and mental, occur; and in severe cases sensation may be lost, syncope is frequently apt to occur, and even death may result.

The disease seems to go through different changes, according to the causes which bring about the anæmic condition. After mere loss of blood in quantity, for instance, the water and the salts are renewed with most rapidity, the albumen later, then the colourless corpuscles, and last of all the red corpuscles. Hence it is that

anæmia is frequently associated with a watery condition of the blood, as well as with a lessening of the number of the blood-cells. It is a matter of the greatest importance in practice to distinguish, if possible, between these conditions, with a view to a rational means of treatment.

Those exhausting diseases which are attended especially with deranged nutrition and sanguification, such as *Bright's disease*, *carcinomatous diseases*, *tuberculosis*, and *suppuration*, lead also to the development of that form of anæmia in which the *liquor sanguinis* is in excess, in which the blood is poor in albumen, containing an excess of salts, and in which the blood-cells ultimately become deficient. A tendency to *general dropsy* or to diarrhœa ensues, nutrition becomes still more disordered, and new formations are apt to become developed. By "*general dropsy*" is understood "*an accumulation of serum in the areolar tissue, with or without effusion into the serous cavities.*"

It is very important to know, in a practical point of view, that every acute disease which occurs in an anæmic individual assumes a peculiar character: a very high degree of debility and prostration ensues, convalescence is protracted, and all severe intercurrent diseases acquire a lingering course.

Symptoms.—In combination with an investigation of the blood, the symptoms and signs of *anæmia* are already read in its pathology. It is only by general symptoms, however, that the physician is able circumstantially to conclude that relative diminution of the cells of the blood co-exists with deficiency of the mass. Great debility is a prominent and striking feature. The skin is of a pale, waxen colour; the "whites" of the eyes have a bluish aspect; the mucous membrane of the mouth is colourless; the gums and lips are white; and the tongue is pale, large, and flabby; the pulse in general is about 80, but very feeble, and easily excited—the least stimulus, the least mental emotion or movement of the body, produces great momentary acceleration of the pulse. Respiration is hurried on the least exertion. The appetite is bad, and thirst prevails. When the disease has existed for some time, œdema of the feet and ankles may supervene; and, finally, sweating, in the extreme stage of *anæmia*. It occurs most frequently in the last stages of severe and exhausting sickness of a lingering and prolonged kind, where a high degree of paleness of the skin and mucous membranes

exists, with a small weak pulse, collapse of the veins, and a small volume of the heart, spleen, and liver.

In recent days diagnostic characters of *anæmia* have been recognized in various *murmurs* which may be heard in some parts of the vascular system of anæmic patients. Although the seat, the causes, and the signification of these *murmurs* have been very much disputed, yet the following account may be given of them, based on numerous observations and investigations, especially those of Vogel and of Walshe.

There are three kinds of anæmic *murmurs* which may be distinguished, namely—(1.) *Cardiac murmurs;* (2.) *Arterial murmurs;* and (3.) *Venous murmurs.*

The *cardiac anæmic murmur* gives forth what is usually called a "bellows sound," sometimes intense, sometimes faint, and which generally accompanies the first ventricular sound of the heart. The position where these *systolic* cardiac murmurs is best heard is of some importance, as indicating anæmia rather than disease of the heart. They are heard towards the base of the heart in anæmia, rather than towards the apex, as in organic disease of the valves (WALSHE). The *diastolic* murmurs are really of venous origin; and their intensity is more or less increased by suspension of the respiration.

The *cardiac anæmic murmur* occurs most frequently in true anæmia, especially if cardiac excitement is associated with it; and simultaneously with it we frequently hear *arterial* and even *venous murmurs.* It has been observed by Vogel and others, however, that while the presence of these *cardiac murmurs* may be employed as an auxiliary sign together with others in the diagnosis of anæmia, yet it is not to be concluded from their non-existence that anæmia is not present. Such *murmurs* are not heard in all anæmic patients; and, although present, they are not in every case due to anæmia, because they occur in organic diseases of the heart, such as valvular diseases and endocarditis; and a physician trusting to and acting upon stethoscopic signs *merely,* without a due appreciation of general symptoms, seriously injures the patient, and does an injustice to the science of medicine.

The *arterial anæmic murmurs* are seldom heard. They consist of an intermittent blowing, sometimes soft, sometimes sharp sound, perceived to be synchronous with the beat of the pulse,

which gives at the same time a thrill to the finger, so that the *murmur* may be inferred by practice from the nature of the pulse. It is only in the larger arteries in which they are heard, such as the brachial, the subclavian, the femoral, the carotid, and abdominal aorta. They are most frequently heard after great losses of blood; and sometimes also in *chlorosis*. Vogel has heard them during the paroxysms of intermittent fever, while they are absent during the intermissions. They may be heard in typhus fever. No positive conclusion can therefore be formed from them alone regarding anæmia.

The *venous murmurs*, or *hums*, significant of *anæmia*, are *continuous*, humming, buzzing, occasionally musical, singing murmurs, easily distinguishable from the blowing *intermittent* arterial murmurs. They are most frequently heard on the right side of the neck, at the junction of the external and internal jugular vein; but they may also be heard in the femoral veins in their maximum degree of intensity. They may be heard, also, over the course of the superior longitudinal sinus, and at the maximum intensity over the *torcular Herophili* (WALSHE). They are supposed to be produced by abnormal oscillations of the venous valves, or by sharp collision among the blood-discs, passing from sideward veins into a large vessel. When the venous murmurs are strong, they may not only be *heard*, but also felt as a gentle thrill, by placing the finger on the part.

These venous murmurs are seldom absent in well-marked anæmia. Nevertheless, anæmia is not to be positively inferred from the mere presence of any one of these murmurs.

One constant urinary character attends both anæmia and chlorosis—namely, a diminution in the urine pigment, which is often reduced to one-fourth or one-sixth of its normal amount. Very generally there is also lessening of the free acidity; and urine which is pale and almost neutral during the whole of the twenty-four hours is almost as good an indication for the use of iron as the pallor of the skin itself. The amount of iron in the urine of anæmia is often very small. The quantity of urine may not be decreased, and may be in some cases large. Its specific gravity is low, (PARKES, l. c.) With regard to other constituents, such as urea and uric acid, the accounts are very contradictory.

Causes.—As an independent constitutional disease, anæmia may

be said to owe its origin to three sets of conditions,—(1.) Copious loss of blood, such as by hæmorrhage or venesection, or oft-repeated small losses of blood. (2.) From loss of other fluids of the body besides blood, especially of such as contain albuminous, fibrinous, mucinous, or caseinous substances, such as the excessive secretion of milk in protracted suckling, suppuration, profuse blenorrhœa, leucorrhœa, diarrhœa. (3.) From insufficient and improper nutriment, or from disturbances in the absorption and assimilation of food, and the process of sanguification; or from repeated temporary interruptions to oxygenations of the blood, as by imperfect ventilation of sleeping rooms or coal mines. (4.) It may result from the co-operation of many influences; for example, excessive bodily and mental labour; continued excitement, pain, care, grief, hardships; many acute and chronic diseases, some of which augment the consumption of blood, while others impede its formation—this effect being produced by an acute disease under certain circumstances, when its invasion is intense and its duration prolonged, such as by *tuberculosis*, carcinomatous diseases, *diabetes;* from poisoning by malaria—the *malaria-chlorosis* of Vogel, or *paludal cachexia* of Martin, as in the "used-up" condition of our Bulgarian troops, described by Dr. H. Mapleton in *Parliamentary Paper* 247, for 1856, p. 253. "It is the most general of all the conditions incident to tropical invalids" (MARTIN).

Treatment.—The energies of the physician must be directed to discover and counteract the cause of the anæmia. Nutritious substances must be supplied for diet, in the shape of easily digested meat and broths. The purely tonic treatment, in the combination of air, exercise, and diet, must be carried out as far as practicable. A change of air is absolutely necessary, and generally also of diet. Iron is one of the best medicinal remedies. The astringent preparations are pre-eminently tonic; and are especially useful when the anæmia is associated with or dependent upon inordinate discharges. *Solution of the perchloride of iron,* in the form of *tinctura ferri perchloridi*, in doses of ten to thirty minims in water, or *infusion of quassia* or of *calumba* has properties in common with the numerous salts of iron, and is one of the most reliable preparations. If the anæmia is associated with *diarrhœa,* or *menorrhagia,* or *leucorrhœa,* the *solution of the pernitrate of iron* in similar doses is attended with benefit. A

preparation which is new to the pharmacopœia—*the syrup of the phosphate of iron*—possesses the general properties of the ferruginous compounds, and is of great service when the *anæmia* is associated with certain forms of *dyspepsia*, or with *amenorrhœa*. It invigorates and increases the powers of digestion, and may be given to the extent of one to three drachms for a dose in water. Another phosphatic preparation of very great value is that which has been devised by the late Dr. Easton, Professor of *Materia Medica* in the University of Glasgow. Although it is not in the pharmacopœia, and although its mode of preparation had not been published before Dr. Easton kindly sent it to me for publication in the previous editions of this work, yet the combination has become very popular throughout the country as a general tonic in *anæmia* and *cachexiæ* generally. As such, it has been largely used by my colleagues, Professors Maclean and Longmore, amongst the used-up cachectic and anæmic soldiers under treatment at the Royal Victoria Hospital at Netley; and I would add my testimony to its being a most valuable medicine in general practice. The following is the original formula devised by Dr. Easton for the preparation of the *phosphates* of *iron*, *quinine*, and *strychniæ*, in the form of a syrup ("*Syrupus ferri, quiniæ et strychniæ phosphatum*"):—

℞. Ferri Sulph., ʒv.; Sodæ Phosph., ʒvi.;* Quiniæ Sulph., grs. cxcii.; Acid. Sulph. Dil., q. s.; Aquæ Ammoniæ, q. s.; Strychniæ, grs. vi.; Acid. Phosph. Dil., ʒxiv.; Sacchar. Alb., ʒxiv.

"Dissolve the sulphate of iron in one oz. boiling water, and the phosphate of soda in two oz. boiling water. Mix the solutions, and wash the precipitated phosphate of iron till the washings are tasteless. With sufficient diluted sulphuric acid, dissolve the sulphate of quinia in two oz. water. Precipitate the quinia with ammonia water, and carefully wash it. Dissolve the phosphate of iron and the quinia thus obtained, as also the strychnia, in the diluted phosphoric acid; then add the sugar, and dissolve the whole, and mix without heat. The above syrup contains about one grain phosphate of iron, one grain phosphate of quinia, and one thirty-second of a grain of phosphate of strychnia in each drachm. The dose might therefore be a tea-spoonful three times a day.

"The amount of phosphate of quinia might be increased according to circumstances; and if eight grains of strychnia were employed in place of six, as in the above, the phosphate of strychnia would be in the proportion of the one twenty-fourth of a grain in every fluid drachm of the syrup. I would scarcely venture on a much larger dose. In cases of delicate children, with pale countenances and deficient appetites, I have given, with great benefit, a combination of equal parts of

* A little more phosphate of soda gives a better result—say ʒi

the above syrup and of that prepared by Mr. Edward Parrish, often called chemical food. To children between two and five years of age, the dose of this combination may be a tea-spoonful three times daily."

It is prepared by Messrs. Murdoch, chemists, in Glasgow; by Duncan and Flockhart, in Edinburgh; by Randall and Sons, Southampton; and by Savory and Moore, in London.

In some cases the *astringent* preparations of iron are not suitable, and are apt to irritate delicate stomachs, or those in whom any inflammatory local disease exists. For delicate females and children the *saccharated carbonate of iron* is a most valuable preparation, in the form of *mistura ferri composita*, to the extent of one to two ounces for a dose; or in the form of the *pilula ferri carbonatis*, in doses of from five to twenty grains in the twenty-four hours. The *citrate of iron and ammonia* is another remedy which possesses scarcely any astringency, and may often be given in cases of anæmia when the stomach will not bear more astringent preparations. Five to ten grains of this salt may be taken during the twenty-four hours. It is best taken during effervescence, prescribed in *solution of citric acid*, and *not* in *bicarbonate of potash solution*. If it is put into the latter, carbonic acid will be given off, and probably burst the bottle. *Tincture of orange-peel* is the best flavouring agent; but as the salt will not dissolve in the tincture alone, it is necessary to dissolve the salt in water first, and then add the tincture, otherwise the division into doses is impracticable (SQUIRE).

When it is desirable to continue the use of iron for a long time, as in the *anæmia* of neuralgic affections or *tic-douloureux*, or to give it in large doses, the *magnetic oxide of iron* is the best preparation to administer in doses of five to twenty grains twice or thrice a day in water. The *reduced iron*—the *ferrum reductum* of the British Pharmacopœia—is also a remedy which does not possess the astringent properties of the other preparations, and is one of the most powerful remedial agents in cases of anænia. *One* to *five* grains may be given several times a day in powder or in pill. It has no taste, and *one* grain is equal medicinally to *five* grains of the citrate of iron. The *citrate of iron* and *quinine*, either in solution or in the form of a pill, is a new and useful preparation, in doses of *five* to *ten* grains three times a day. Such a preparation of iron must be found as will not check the digestion of other food. If loss of appetite and feverishness prevail, the form of the remedy is probably unsuitable, and requires to be

changed. Chlorine, in the form of warm hydrochloric acid baths, is highly spoken of by Dr. T. K. Chambers, as an agent of great value, and as a directly restorative medicine in anæmia (l. c., p. 332). The bowels are to be kept regular by four grains of the pills of aloes and myrrh taken at bedtime.

Ferruginous remedies are always of use when we have reason to believe that there is a diminished energy in the formation of blood-cells; and if the urine be pale and almost neutral during the whole of twenty-four hours, it is as good an indication for the use of iron as the pallor of the skin in cases of *anæmia* (PARKES).

GREEN SICKNESS—SYN., CHLOROSIS.

LATIN EQ., *Chlorosis*—Idem valet, *Pallor luteus fœminarum;* FRENCH EQ., *Chlorose;* GERMAN EQ., *Chlorose*—Syn., *Bleichsucht;* ITALIAN EQ., *Clorosi.*

Definition.—*A deficiency of the blood-cells, with redundancy of the serous part of the blood, occurring in young girls at the age of puberty, and sometimes in the young of both sexes before the complete development of the distinctive characters of the sexes towards puberty has been effected.*

Pathology and Symptoms.—A very indefinite idea is associated with the name and nature of this disease. Many employ the term precisely in the same sense as *anæmia;* or they limit the term *chlorosis* to those forms of anæmia whose causes are unknown. The original use of the term is expressed in the first part of the definition, as limited to that form of anæmia which occurs in the female at the period of puberty. It is to be classed amongst the "*functional diseases of the female organs of generation in the unimpregnated state.*"

A change in the complexion constitutes the most striking symptoms of chlorosis. A marked pallor of the skin prevails, sometimes perfectly pale, at other times yellowish, greenish, or waxen coloured. The lips and mucous membranes are also pale—symptoms which are the result of the deficiency of blood-cells, and so of blood-pigment. Slight dropsical swellings occur, such as œdema of the feet and ankles, the face and the eyelids, and a bluish halo sometimes encircles the orbit.

The temperature of the body is generally diminished—the breath is cool, the lips, nose, ears, hands, and feet are cold; and chilliness of the body prevails, which is morbidly sensitive to

external cold, and seeks warmth. As in other forms of anæmia, the patient suffers from great prostration of strength and debility; she is tired by the slightest exertion, and the weakness sometimes becomes so great as to lead to fainting. The patient is languid, listless, sedentary, and indisposed to exertion. She is nervous, low-spirited, and frequently a prey to irregularities of temper.

Hysteria may prevail with chlorosis. The patient frequently suffers from vertigo, headache, often recurrent, *tinnitus aurium*, especially of the right ear, sparks in the eyes, tendency to fainting, neuralgia, spinal irritation, and convulsions, or a "heaviness for sleep." The mind is sometimes morbidly impressed with grief, while despondency and frightful dreams prevail; there is the apprehension of nightmare, melancholy thoughts predominate, mania may become confirmed, and the insanity may assume a suicidal tendency.

Disorders of digestion attend the disease. Appetite is diminished or perverted, or even depraved. Acids and highly flavoured foods are craved for, and sometimes such substances as chalk, paper, ashes, coal, plaster of Paris, hair, earth, and even excrements, are desired to be eaten. Substances also very difficult of digestion are longed for, and are sometimes digested better than simpler kinds of food. Constipation frequently and obstinately co-exists; but afterwards diarrhœa may alternate, and lead to *hæmatemesis* or *melæna*, when the evacuations are usually scanty, dark-coloured, and fetid. A singular and peculiar pain of one or both sides, which suffer together or alternately, is a frequent symptom. It is referred generally to the region over the false ribs and the *ilia*. The recurrent nature, the particular situation, and the alternating character of the pain, are peculiar and characteristic. It is not aggravated by a deep inspiration, although it may seem to be so at first.

Other functions are no less disordered—for instance, the respiratory, the generative, and the circulatory.

Respiration is oppressed, or performed with difficulty, and the breath is offensive. Breathlessness prevails, and is experienced especially on any exertion; sometimes also fits of dyspnœa; and sometimes a sonorous cough occurs. Menstruation is generally absent or performed imperfectly, irregularly, and with pain, and the flow is thin and watery, or leucorrhœal. The condition of

the menstrual discharge is generally very easily impaired. The catamenia become irregular in their return, inconstant, or of short duration in their flow, deficient in quantity, and pale in colour, and terminating in a state of leucorrhœa. In some cases each return of the catamenia is preceded and attended with much pain in the back and in the region of the uterus. Later in the disease there may be complete *amenorrhœa.*

The conditions of the vascular system are variable. The pulse is slow, feeble, and soft, but sometimes frequent, and always easily accelerated; the heart and great vessels are irritable; palpitation is common; or, more frequently, a sense of fluttering in the *præcordia,* with irregular action of the heart, or imperfect syncope and murmurs, as already described, may prevail. It is to be observed, however, that, apart from mere lassitude and palpitation, patients are sometimes chlorotic for weeks, without any other marked symptoms; and the same complication of intercurrent acute diseases is apt to happen as described under anæmia. The condition of the urine is similar to that which prevails in anæmia.

Causes.—The conditions which bring about this constitutional affection are similar to those already mentioned. The disease is frequent in females between the ages of *sixteen* and *twenty-five* years, is often of long duration, lasting for months, and even for years, with a tendency to relapse after cure.

Diagnosis.—It is especially necessary that the physician should not confound *chlorosis* with *jaundice* on the one hand, or *disease of the heart* on the other, or with incipient *pulmonary tuberculosis,* or inflammation within the chest or abdomen.

Treatment is chiefly conducted by change of air and diet, and by medicines. All the functions of the body must be carefully observed, watched, and regulated. The residence of the patient must be a reputed healthy spot in the pure air of the country, rather than the town. Dry frictions of the back and limbs are also recommended, with bathing in the sea, where it can be borne.

The food must be regulated so as not to be too stimulating nor disgustingly bland;—frequent change is demanded, with a due attention to the proper apportioning of nutritive and respiratory elements. The diet should be generous; and carefully apportioned to the powers of digestion. Any symptoms of dyspeptic oppression, impaired digestion, or offensive stools, demand a

careful re-adjustment of the dietary. Three meals, or perhaps four, may be taken during the day—the intervals between the meals being equal; and, half an hour before each of the meals, two grains of *capsicum*, with one grain of *quinine*, may be given in a pill. The breakfast should consist of biscuit, dry toast, or stale bread, with fresh butter and perhaps an egg, and one small cupful—not more—of hot black tea. Five or six hours after breakfast, and after the pill, a dinner of *well-done* meat, such as mutton chops, may be eaten with potatoes; porter, beef-tea, or milk being taken for drink, according to taste and the powers of digestion. The evening meal may be similar to the morning. At first there may be a loathing of all kinds of food in the form of regular or "ordinary diets." In such cases no meals should be prescribed, and no solid food; but a cup of milk, with a third part of lime-water in it, may be given every two hours, prescribed as a medicine, and a pint of beef-tea in divided doses may be taken as a drink during the day. This diet may be gradually added to as the appetite improves.

Change of air and bathing will also greatly aid in restoring health. If the patient lives in a town, she ought to be sent into the country; and, best of all, to the sea-side, where sea-bathing may be prescribed, if the strength of the patient is sufficient. Should the patient have been living in the country, a change of air and scene to a lively town will be no less useful as a remedial agent.

The much-be-quacked use of water, in its varied modes of appliance to particular cases, will be found a powerful restorative agent, if judiciously used by the patient under medical advice.

Of medicines, the preparations of iron have most reputation. They seem to act by promoting the formation of the red blood-corpuscles; and they operate best in those cases in which the blood is rich in albumen. They also act as stimulants to digestion; and, from what has been stated at page 61, it is not altogether immaterial which of the numerous *officinal* preparations of iron are to be prescribed. Almost every physician has some preparation of iron he fancies better than another; and some of them seem to be aided in their good effects by combination with *carbonate of potash*, such as the *sulphate of iron*, in doses of *three* to *five* grains, or of the *ferri sulphas exsiccata*, in doses of two to five grains, prescribed in pills. The use of ferruginous

remedies must be persevered in for months, and the general indications for prescribing the preparations are the same as those given under anæmia, page 61. In pills, the iron preparations may also be combined with *extract* of *nux vomica*, or with *strychnia*, in suitable doses; or the syrup of the phosphates of iron, quinine, and strychnia may be given (see page 62); or the eliminative action of the colon is to be promoted by four grains of the pill of aloes and myrrh taken every night at bedtime, or by a grain of the *watery extract of Barbadoes aloes* with a little *gingerine* as a pill. Simple bitter tonics are useful adjuncts to the chalybeate treatment, such as *gentian*, *calumba*, and the preparations of *cinchona*. They aid feeble digestion.

Where a high degree of serous plethora exists, and produces violent excitement of the vascular system, palpitation of the heart, and congestion of the head, venesection may be practised. It not only acts as a sedative, but aids the radical cure of the disease, inasmuch as it causes the subsequently administered ferruginous preparations to be borne more easily. Both general and local blood-lettings may be used; but the blood must be taken in small quantities, a couple of ounces at a time being quite sufficient (VOGEL),

Tartarated iron (*Ferrum tartaratum*) is also a useful remedy, and may be prescribed with alkalies, in doses of six to twenty grains, dissolved in water.

LEUCOCYTHÆMIA—SYN., WHITE-CELL BLOOD, OR WHITE BLOOD.

LATIN EQ., *Leucocythæmia;* FRENCH EQ., *Leucocythémie;* GERMAN EQ., *Leukæmie*—Syn., *Leucocythæmie;* ITALIAN EQ., *Leucocitemia.*

Definition.—*A disease* sui generis, *in which the number of white corpuscles in the blood is greatly increased, with a simultaneous diminution of the red. This state is brought about by chronic exhausting diseases, exposure to cold and wet, or serious acute affections—such as typhus fever, pneumonia, puerperal fever, affections of the lymphatic glands, or of the spleen, and is attended sometimes by cough or diarrhœa, epistaxis, hæmorrhagic effusions, furunculous or pustulous eruptions.*

Pathology.—In the present state of our knowledge regarding leucocythæmia, an account of the phenomena which attend upon its course is all that can be given.

Having conveyed, in the previous editions of this work, an erroneous chronological account of the discovery of this remarkable disease, and of the steps through which the views regarding its pathology, as at present entertained, were successively reached, I am the more anxious now to do justice to those distinguished men whose conjoined investigations have enriched science with the knowledge of leucocythæmia which we now possess.

In the sixty-fourth volume of the *Edinburgh Medical and Surgical Journal* a case of disease of the spleen is described by Dr. Craigie, "in which death took place in consequence of purulent matter in the blood." The case occurred in 1841, and proved fatal on the 1st of April of that year. The late Dr. John Reid examined the case, and, "on examining the blood of the veins of the abdomen and sinuses of the brain by the microscope," found "that it contained globules of purulent matter and lymph." Dr. Craigie inferred "that, by some means or other, purulent matter and lymph had been mixed with the blood, and, circulating with it, had given rise to the peculiar febrile and inflammatory symptoms which occurred during life, and to death in the manner in which it had taken place." He inferred—that the spleen was the only organ from which the purulent matter and lymph could have proceeded, it having been for several weeks in a state of chronic inflammation — that in this form of disease of the spleen the pus-cells are secreted, and, being mixed with the blood, they cause much disorder in the sanguiferous system, and finally destroy the patient. Dr. Craigie thus clearly recognized a connection between the diseased state of the spleen and the changed condition of the blood; and that "it was in some respects new." On this account he made a correct description of it, expecting at some future period that the chief facts might be confirmed. He kept the case unpublished till 1845, and it was only published then in consequence of the occurrence, to another physician in the same hospital, of a case "in many, if not in all, respects similar, which led Dr. Craigie to anticipate similar results, and which went far, as he thought, to confirm his conclusions deduced from the first case, (*Edin. Med. and Surg. Journal* for 1845, p. 400, *et. seq.*) The details of the second case referred to by Dr. Craigie were published by Dr. Bennett in the same volume of the *Edinburgh Medical and Surgical Journal* immediately after the account of Dr.

Craigie's case. Dr. Bennett describes his case as one of "*Hypertrophy of the Spleen and Liver, in which death took place from suppuration of the Blood;*" and although the most evident lesion during life was enlargement of the spleen, Dr. Bennett agrees with Dr. Craigie "in thinking that the immediate cause of death was owing to the presence of purulent matter in the blood, notwithstanding the absence of any recent inflammation or collection of pus in the tissues," and that it produced the febrile symptoms. In these valuable papers Drs. Bennett and Craigie are at issue, however, about the source of the pus in the blood. Dr. Bennett considered his case particularly valuable, because he believed it demonstrated "the existence of *true pus*, formed universally within the vascular system, independent of any local purulent collection from which it could be derived" (l. c., p. 414). He believed the white corpuscles he saw in the blood "were true pus-globules," and he then was of opinion that they were formed in the *liquor sanguinis* within the vessels, independent of inflammation or of phlebitis, or what was then understood by *pyæmia;* that the transformation had taken place throughout the system, and that the whole mass of blood was affected: and the case appeared to him capable, in this respect, of furnishing an important fact which may serve to throw light on the doctrine of *Zymosis*, as applied in Pathology (l. c., p. 423).

In the same year (1845), about a month after the publication of Dr. Bennett's case, Professor Virchow, of Berlin, described and explained, in *Froriep's Journal*, of November, 1845, a disease of the blood as due to an increased development of white blood-cells. No inflammation of veins was observed; and the hypothesis of any spontaneous formation of pus in the blood (pyæmia) was contrary to the pathological doctrines of Virchow. To this form of disease he gave the name of "white" or "colourless blood." As to its cause, he distinctly points out *as primary* the condition of the spleen, entertaining the idea of an increased formation of colourless blood-cells, through the functional relations of that organ.

In 1845-46 several cases of leucocythæmia during life were recognized in this country. Dr. Fuller, of St. George's Hospital, in December, 1845, was the first to determine this condition during life; and it was also diagnosed by Drs. T. K. Chambers, and Walshe, in London, and by Dr. Douglas, in Edinburgh, in 1846.

Virchow continued to oppose the view of Dr. Bennett as to this affection having its origin in the formation of pus in the blood, or that its formation is in any way of the nature of a *Zymosis;* maintaining, on the contrary, the correctness of his first opinion, that the essence of the disease consisted in an increase of the colourless blood-cells (*Medicinische Zeitung,* August and September, Berlin, 1846).

In 1847 Virchow collected and described cases from the older authors, and compared them with those observed in England and those seen by himself; and finding also a further basis in favour of his views in the theory of Hewson and Donné regarding the function of the spleen in the propagation of the blood, he naturally became more confirmed in his opinion, that from some altered relation of the spleen to the blood-cells might be established those conditions under which "white blood" would be produced. In the *Archiv. of Path. Anatomy* of the same year a case of great value is described by him as a new form of this "white-blood" disease. In this form the spleen presented no change whatever, whilst the lymphatic glands were enormously enlarged. He was now able to declare with more confidence that the "white-blood" disease proceeded from a primary affection of the spleen and lymphatic glands, as a direct consequence of which an increased development of colourless blood-cells takes place; and thus he considers that the disease, in its turn, throws light on the physiological functions of these glands as eliminating organs of the blood.

In 1851-52 Dr. Bennett gave a most interesting and systematic view of the whole subject, first in the *Monthly Journal* of 1851, and afterwards in a separate work, entitled *Leucocythæmia, or White-cell Blood,* in which the explanation of the pathology of this disease is no longer referred to the spontaneous development of pus in the blood.

Although Dr. Bennett originally set out upon what has since been believed to be an erroneous track in the interpretation of the phenomena of leucocythæmia, yet he was the first to show that these phenomena were new to science, while the more apparently correct generalization and elaboration of the subject seems, from the chronological evolution of the history of the disease, to be mainly due to Virchow. He was the first to recognize and regard the colourless cells in leuchæmia

or leucocythæmia to be identical with the colourless globules of the blood—the view at present generally entertained. More recent observation, pointing to the formation of pus from the white corpuscles of the blood, may (if found correct) again change the views now generally entertained. It is greatly to be regretted, however, that so much personality and ill feeling has been imported into the historical records of this interesting discovery; and if the reader desires to read the several sides of the lengthened controversy, let him consult (1.) The original cases of Craigie and Bennett in the sixty-fourth volume of the *Edin. Med. and Surg. Journal;* (2.) A review of Virchow's *Handbook of Pathology,* in the June number of the *Edin. Monthly Med. Journal* for 1854, p. 546; (3.) An able letter by Professor Kölliker, in the October number of the same journal, p. 374; (4.) A Reply by Dr. Bennett to the same, p. 377; (5.) Dr. Bennett's work on *Leucocythæmia;* (6.) Dr. Bennett's more recent Lecture (vi.) in the *Lancet* of April 4, 1863.

The morbid state expressed in the definition has been observed by many physicians and pathologists under various complex conditions of the disease; and hence a variety of opinions have been entertained regarding it in Germany, England, and France, by Vogel, Remak, Henle, Nasse, Weber, Rokitansky, Kölliker, Parkes, Jenner, Gulliver, Piorry, Bichat, Velpeau, and others, who have described cases since Bennett and Virchow first wrote on the subject.

The increase of the colourless corpuscles of the blood, which is the prominent character of this disease, does not seem in any case to have existed or occurred by itself. Other morbid states precede, co-exist, or succeed the augmentation of the colourless corpuscles.

The most frequent complication consists in the enlargement of the spleen. This enlargement is so constant that its existence, if not otherwise accounted for, would at once indicate that leucocythæmia prevailed, and would suggest a microscopic examination of the blood. In nineteen cases, Vogel writes that the splenic enlargement was present in sixteen; and in three cases the weight of the spleen was estimated at more than seven pounds.

Constituents foreign to normal blood have been found by Scherer in a qualitative analysis of the blood in a case of leucocythæmia, where the spleen was enlarged. These consisted of

lactic, acetic, and formic acids, gelatin, and a peculiar substance (hypoxanthin) to the amount of from ·4 to ·6 *per cent.* Scherer finds, also, that this same substance exists naturally in the pulp of the healthy spleen. This form of the disease has been named *splenæmia* by Virchow. In it the globules (white) predominate which are peculiar to the elements of the spleen.

The *liver* is also frequently enlarged in this disease, but not to so remarkable a degree as the spleen. Vogel writes that as often as thirteen times out of nineteen cases it was either enlarged or otherwise morbidly altered.

Affections of the *lymphatic glands* predominate in some cases, rather than enlargements of the *liver* or the *spleen.* According to Vogel, such have been observed eleven times out of nineteen cases. Virchow considers that some kind of lymphatic *diathesis* prevails,—that there is a progressive inclination of the lymphatic system to the formation of the lymphatic elements. In some instances observed by him there seems to have been a new formation of glandular tissue, or that the glandular tissue tended to grow beyond the pre-existing boundaries of the glands. He has observed this development of lymphatic gland tissue to take place in the liver in a remarkable case which contained numerous small whitish granules, about the size of the natural lobules of the liver, and which exhibited under the microscope nuclear and cellular elements quite like those of the lymphatic glands. This infiltration of the liver followed the ramifications of the portal vein. In one of these cases he observed a similar alteration in the kidney.

This constitutes the *lymphatic* form of leuchæmia, or *lymphæmia,* first described by Virchow in 1847.

In such cases the elements of the lymphatic glands prevail in the blood, which is then characterized by innumerable round granulated nuclei, generally provided with nucleoli, of the size of the usual nuclei of the lymphatic glands. Here and there are also to be seen cells consisting of such a nucleus surrounded by a membrane closely attached to it.

There are three possible conditions given by Virchow under which these elementary cells in the blood may originate,—(1.) They may multiply in the blood by the subdivision of pre-existing cells; (2.) They may be primarily introduced into the blood through the lymph or chyle, which are conceived to convey the developed as well as the undeveloped globules derived from the

lymphatic glands, the spleen, and its connecting tissue; (3.) That they are formed on and detached from the walls of the blood-vessels has not been yet proved.

Virchow regards the colourless blood-corpuscles as simple cells, without any specific character, whose transformation into red globules cannot take place; that they therefore form a relatively superfluous constituent of the blood—a kind of excess or waste. The transformation of lymph-globules into red globules takes place before passing into the general circulation; and it appears that if a certain cell, when passing into the blood, has gone beyond that stage of development, it is ever afterwards unfit to undergo its specific coloured metamorphoses. The idea that the cells are of a purulent nature has been now abandoned; and there is no evidence to support the doctrine that they are the result of *pyæmia*. Besides the spleen and the lymphatic glands, the other blood-glands, such as the *thyroid gland* and *supra-renal capsules*, are occasionally degenerated, as well as Peyer's glands and the mesenteric glands; and leucocythæmia may arise from disease in them as well as from the spleen or lymph-glands.

The statistics regarding the ages at which the disease has been observed are given by Vogel as follows:—One case was observed under ten years of age, two between ten and twenty years, three between twenty and thirty years, seven between thirty and forty years, four between forty and fifty years, three between fifty and sixty years, and three between sixty and seventy years.

Symptoms.—In the majority of cases there are obvious indications of general ill-health; and the most prominent symptom has been tumefaction of the abdomen, depending upon an enlarged spleen and liver. Ascites and anasarca of the lower half of the body are not unfrequently present; and a tendency to œdema may commonly be observed, the general surface of the body being usually pale. Transitory pains are frequently experienced in the abdomen.

Intestinal disorders are often also present, such as vomiting, constipation, or diarrhœa, and jaundice is not unfrequent; but diarrhœa is one of the most dangerous complications, and the most difficult to arrest or control.

A considerable amount of dyspnœa may prevail, which cannot be accounted for by elevation of the diaphragm merely. Hæmor-

rhage often occurs in the form of epistaxis, or takes place from the gums. A persistent increased secretion of uric acid has also been observed in the urine. The disease generally runs a chronic course, and a high degree of emaciation ordinarily accompanies it. As in the other forms of anæmia, leucocythæmia is usually well established before it is noticed, and before any remarkable disturbances in the general health have occurred. It is not till towards the fatal termination that any fever sets in, which then assumes the hectic type.

Diagnosis.—The diagnosis of the disease consists in demonstrating the extreme increase of the colourless blood-cells, which may be done as follows:—

1. By microscopic examination of the blood, for which a single drop is sufficient, most conveniently taken from a needle puncture in the finger; and examined under a power of at least 250 diameters. If the disease exists, the colourless corpuscles will be seen to form a sixth, a fourth, or even a half or more of the numbers of the red.

2. If a large quantity of blood is obtainable by venesection or by the cupping glasses, and freed from fibrine by heating, and placed in a high narrow little glass, so that the corpuscles sink to the bottom, the upper part of the mass looks whitish coloured, like milk. The milky character does not vanish on agitation with ether, and is not produced by fat-globules suspended in the blood-serum, but by the prodigious number of the colourless blood-corpuscles.

3. The clot of leucocythæmic blood shows on its surface greyish-white granulations, which, being observed under the microscope, are seen to consist almost entirely of colourless corpuscles, distinguishing the condition in leucocythæmia from the ordinary buffy coat; and the separated serum being clear, and not turbid, distinguishes the condition from a fatty condition of the blood.

4. In the dead subject there are found in the heart and in the great veins large, soft, semi-fluid greyish-yellow coagula, which, on microscopic examination, are seen to consist almost entirely of colourless corpuscles (Vogel).

Causes. — The causes which bring about leucocythæmia are entirely unknown; but it seems several times to have suggested itself to Virchow that acute inflammatory processes may lay the foundation of the morbid state; and in an interesting review

of the writings of Virchow in *The Brit. and For. Med.-Chir. Review* for July, 1857, there is related a case of the lymphatic form of the disease, whose origin obviously dates from inflammatory swellings of the lymphatic glands after exposure to cold and wet. I saw a similar case in Guy's Hospital, in July, 1863. It occurred to a man after exposure to cold and wet, on Epsom Downs, at the time of the races there.

Prognosis.—Hitherto no case of cure is known, and the disease may continue for a lengthened period without a fatal result.

Treatment.—The most varied remedies have been tried, without checking the increased formation of colourless corpuscles; but it is suggested that if it is possible to discover the glandular or splenic affection early, before the alteration of the blood has made much progress, it is probable that the disease may be averted. Tonics, nutrients, and stimulants are indicated, to support the system. The use of the nitro-muriatic bath ought not to be neglected, and the indications given under anæmia and chlorosis may be followed.

ADDISON'S DISEASE—Syn., BRONZE SKIN.

Latin Eq., *Morbus Addisoni*—Idem valet, *Cutis ærea, Melasma Addisoni;* French Eq., *Maladie d'Addison;* German Eq., *Addison'sche Krankheit;* Italian Eq., *Malattia dell'Addison.*

Definition.—*A morbid state which establishes itself with extreme insidiousness, whose characteristic features are anæmia, general languor and debility, and extreme prostration, expressed by loss of muscular power, weakness of pulse, remarkable feebleness of the heart's action, breathlessness upon slight exertion, dimness of sight, functional weakness and irritability of the stomach, and a peculiar uniform discoloration of the skin, which becomes of a brownish olive-green hue, like that of a mulatto, occurring in connection with a certain diseased condition of the supra-renal capsules. The progress of the disease is very slow, extending on an average over one year and a half; but may be prolonged over four or five. The tendency to death is by asthenia, the heart becoming utterly powerless, as if its natural stimulus—the blood—had ceased to act.*

Pathology.—The pathological significance of morbid states of the supra-renal capsules was brought prominently before the profession, both in this country and on the Continent, by the

original observations of the late Dr. Addison, then the senior physician of Guy's Hospital. The cases recorded in the medical journals since Dr. Addison wrote, which connect uniform discoloration of the skin (a condition now known by the name of "bronzing") with various morbid states of the *supra-renal* bodies, are now so numerous that, as a clinical fact, the connection cannot be disputed; but the exact relationship and pathological significance of the morbid states thus connected are still open questions, especially as regards the pathology of the constitutional cachexia which exists. Morbid states of the *supra-renal* capsules are not always attended with bronzing of the skin. It appears, indeed, if the cases recorded are carefully analyzed, that symptoms and phenomena of a very important kind have been lost sight of in describing this constitutional disease, while an undue importance has been placed upon the bronzing of the skin. It is to the cachexia that Dr. Addison calls special attention; but his commentators have been carried away by the inquiry regarding the colour of the skin and its connection with the capsular disease. These writers have overlooked the more important portion of his observations, and have been induced to consider the *causes* and *nature* of the bronzing of the skin, which, being established, may be received as a most valuable symptom of a prevailing constitutional cachexia, in which the abnormal deposit of pigment is associated with anæmia and intense prostration, with the phenomena stated in the definition. There can be no doubt that the bronzing must appear of very secondary importance compared with the symptoms and pathology of that peculiar cachexia which attends the cases of *supra-renal* capsular disease, as described by Drs. Addison and Wilks. There seems to be no doubt that the cases Dr. Addison described belong to the class of diseases now under consideration; and that they are similar in many respects to forms of anæmia already noticed, and more especially to leucocythæmia. "In almost all the cases," writes Mr. Hutchinson, "there would seem to have been great deprivation of the coloured constituents of the blood, as manifested by the pallor of those parts of the skin not involved in the bronzing, the great flabbiness of the muscles, and the pearly state of the conjunctivæ." By a strange oversight, however, it would appear that the blood has been subjected to but few examinations. "In two only" of the cases, writes the same

author, "was the blood examined, and in both of them it was found to be loaded with white corpuscles." In all the cases a most remarkable and fatal cachexia prevails, and the value of Dr. Addison's observations consists in showing that a peculiar bronzing of the skin, combined with *asthenia*—of which emaciation is not a necessary accompaniment—attends this cachexia, and indicates organic disease of the *supra-renal* capsules associated with this constitutional state. His observations are at the same time of the greatest value, as showing how well-directed pathological inquiry may advance the science of physiology, for the cases detailed throw some light on the influence, at least, of the *supra-renal* capsules in the maintenance of health.

Although the change of colour of the skin would seem to be a most marked and constant symptom, still it does not appear, as has been stated by a reviewer of Dr. Addison's work, that this change "is one of the earliest symptoms of the disease." On the contrary, there are good grounds for believing, both from the history of the cases and from physiological experiment and observation, that the change in the colour of the skin which has been termed "*bronzing*" does not come on for a long time—that from its nature as a pigmentary change it is of slow production; that while, in almost all the well-marked cases in which it has occurred, the symptoms had existed from one to three years, in other cases where it did not exist it has been alleged that time was not afforded between the establishment of lesions in the supra-renal bodies and the fatal issue for the production of the pigmentary deposit. The change of colour seems to depend on the chronicity of the disease; so that, if the disease progresses rapidly, no discoloration is observed, the phenomena being simply those of asthenia. One very important point is thus remarkably deficient of illustration — namely, *the early symptoms of this cachexia* independent of *bronzing of the skin.* From what has been shown relative to the disease, it would appear that when *bronzing* of the skin has been established, a sign of disease has been discovered when it is too late to be of any service, for all the cases appear to have terminated fatally in which this state was unequivocally established.

In malarious, malignant, and cachectic diseases it is not unusual, but rather the rule, for the serum of the blood to assume a dark and dirty hue, and that ultimately the cutaneous surface comes

closely to approach the colour of jaundice, differing from it only in being more lurid and dusky; and it is believed that the hue of the skin, which becomes of so dark a tinge in some malignant organic diseases, is due to the admixture of morbid matters absorbed from the seat of local mischief, and which so tinges the serum of the blood that the *rete mucosum* is rendered dark. If, then, it is true that in this cachexia the supra-renal capsules are always diseased, and if it be true, as M. Vulpian has found (*Med. Times*, October 4, 1856), that the *supra-renal capsules* differ from all other organs in the body, in the presence of a substance which has two peculiar re-actions, one with perchloride of iron and the other with the tincture of iodine, the first of which gives a dark-blue tint, is it not probable that the coloration of the skin in *supra-renal capsule* diseases may result partly from—(1.) The cachectic state; (2.) The organic lesion of the *supra-renal capsules;* and (3.) The re-action of the peculiar substance in these bodies upon the iron of the blood, which the morbid organic changes in them have allowed to mingle with the circulating fluid? It is, unfortunately, the *supra-renal capsules* only which have been carefully examined in the cases recorded; and in connection with the cachexia and the "bronzing," the lesions they exhibit have been described as of a very variable character, consisting of (*a.*) Acute or recent inflammation ending in abscess; (*b.*) Atrophy with concretions; (*c.*) The conversion of the organs into indurated fibroid enlargements; (*d.*) Tuberculous deposition in various stages; (*e.*) Carcinomatous deposition.

A definite lesion, however, has been recently pointed out by Dr. Wilks, which will be referred to presently.

Sometimes the lesion appears to have been secondary to morbid conditions, apparently of a similar nature, in other parts, all of which must therefore be interpreted as several local expressions of the constitutional disease which prevails; and occasionally the capsules seem to have been the only structures in which lesions were detected; while the degree of "bronzing" of the skin appears to have been proportionate to the length of time which the *supra-renal capsules* are presumed to have been diseased; but neither the time nor the number of cases in which such a proportion can be traced is accurately made out. The general symptoms are those of a person constitutionally diseased, *not* always proportionate in their severity either to the nature or to the extent of

the disease in the *supra-renal capsules.* The *post-mortem* appearances seem to have been in some instances associated with the tuberculous diathesis; but in the best-marked cases there has been no appearance of tubercle on any part of the body (WILKS); and in no case of general tuberculosis has Dr. Wilks ever met with an instance where the *supra-renal capsules* were affected in the manner of Addison's disease. In some cases the spleen was much enlarged, the kidneys pale, and in the last stage of fatty degeneration (TAYLOR). Out of 500 cases of *post-mortem* examinations of all kinds of cases, made at Guy's Hospital by Dr. Wilks, only two instances were observed in which, the *supra-renal capsules* being morbid, the skin did not betray the lesion by "bronzing." In some cases the mesenteric glands are stated to have been enlarged; and calcareous concretions have been noticed in the *medulla oblongata.*

Gastro-intestinal disturbance prevails during life; and a condition of mucous membrane is found after death which may be associated in its pathology with this irritation. The stomach is often ecchymosed, and the glands of the intestines enlarged. In several cases Brunner's glands in the duodenum, and the solitary glands in the lower end of the ileum and in the colon, were very prominent.

In one case which, through the kindness of my first teacher, the late Dr. William Monro, of Dundee, I had an opportunity of carefully inspecting after death, in June, 1856, the following lesions existed:—"The body generally was anæmic. The dark colouring of the skin was most conspicuous in the vicinity of the knees, and on the lateral and posterior regions of the neck. The deposits of pigment gave to the parts a dirty sordes-like appearance where the mucous membrane of the skin meets the lips, and especially at the angles of the mouth. The heart was small and flabby. Tuberculous deposits were sparingly disseminated throughout the apices of both lungs. The spleen, the liver, and the kidneys were severally adherent to the adjacent parts, but their structures appeared normal. The supra-renal capsules were morbid, and the sympathetic nerves from the lesser *splanchnic* were greatly increased in size, as were the ganglia of the *solar plexus* towards the side of the organ most diseased and in contact with it. The texture of the nervous parts was of a bright rosy hue, as if under the influence of vascular excitement.

The mucous membrane of the mouth was thin, pale, and bloodless, the labial and buccal glands shining prominently through. The stomach and glandular substance of the intestinal tube were uniformly thin throughout. In the stomach the solitary gastric glands were remarkably prominent, while the mucous membrane generally was wasted and atrophic. Microscopic sections from the jejunum and ileum showed the villi remarkably attenuated, and the mucous membrane very readily separated from the adjacent muscular part of the gut. The tubular glands of the mucous membrane of various parts examined were almost entirely gone, and their place supplied by granular amorphous material. The average specific gravity of the mucous membrane of the intestines was 1·040.

There are good grounds for believing that Addison himself entertained the belief that death in such cases may be due to the implication eventually of the ganglionic nerves. Some of the symptoms point to this; and of the special phenomena associated with the cachexia, it may be said that the nervous centres are at least impaired. It has occurred to me also, that, in cases of this disease, all the viscera ought to be examined as to the re-action of their minute blood-vessels with iodine, as there are some phenomena which seem to indicate the not improbable co-existence of *amyloid* degeneration; and the lesion in the *supra-renal capsule* ought especially to be investigated in this direction.

The state of the skin, which has been termed "bronzing," strongly resembles the colour of a mulatto, or of a bronzed statue from which the gloss has been rubbed off. It has been examined microscopically by Dr. Wilks, Mr. Tuffen West, and M. Robin, of Paris. The sections show a layer of very distinct pigment-granules in the *rete mucosum*, limited to that structure, and exactly resembling that of a negro. The pigment is deposited in granules, but in some instances coloured cells are visible.

Before detailing the symptoms observed in the remarkable cachexia from which these lesions result, it is necessary again to draw attention to our very incomplete knowledge regarding many points in its pathology, and especially regarding the state of the blood, and the morbid tendencies of the relatives and progenitors of the patient. While the apparent connection of bronzing of the skin with lesions in the *supra-renal capsules*

appears to be evident, our information is of the most deficient kind regarding the chronological sequence of the various symptoms which indicate the establishment of the constitutional disease.

Morbid Anatomy.—The special disease of the capsules in Addison's disease is described by Dr. Wilks as being of one form only —namely, that which was seen in the earlier cases described by Addison, and which he simply styled as "scrofulous." Judging from the material alone, it would be difficult to form an opinion of its nature, seeing that a degenerating inflammatory substance would produce a very similar appearance to a so-called scrofulous one. It is only in exceptional cases that any well-marked tubercular deposit has been found in other viscera. "When the disease is recent, the organ is somewhat enlarged, and changed into a material which is semi-translucent, of a grey colour, softish, homogeneous, and which, when examined microscopically, is found to be without structure, or sometimes slightly fibrillated, or containing a few abortive nuclei or cells. This lardaceous kind of material is the first deposited, and resembles what is often seen in the early stages of scrofulous enlargement of the lymphatic glands; subsequently it undergoes a decay or degeneration, as in these glands, and changes into an opaque yellowish substance; and thus the two materials are constantly found associated. At a later period, as in a scrofulous gland, this may soften into a putty-like matter, "or it may dry up, leaving the mineral part as a chalky deposit, scattered through the organs. These, then, are the changes—first, the deposition of a translucent, softish, homogeneous substance; subsequently the degeneration of this into a yellowish-white opaque matter; and afterwards a softening into a so-called abscess, or drying up into a chalky mass. Occasionally, also, some fibrous tissue may be found round the organs, being the product of an inflammation which has united them to the kidney, liver, and adjacent parts" (Wilks). Some years are necessary for the production of these changes.

Symptoms.—As in the forms of anæmia already described, so in this disease, the patient has considerable difficulty in assigning the number of weeks, or even months, that may have elapsed since he first experienced indications of failing health and strength; and the rapidity with which the local lesions seem to develop themselves varies in different cases—a few weeks being sometimes sufficient

to break up the powers of the constitution, or even to destroy life. Dr. Addison believed that this event is the more speedy in proportion to the rapid and extensive destruction of the *supra-renal bodies*. The important features of the disease, as set forth by Dr. Addison, are,—a progressive feebleness of the patient, without any apparent or known cause (*asthenia*), anæmia, general languor and debility, remarkable feebleness of the heart's action, irritability and weakness of the stomach, and a peculiar change of colour of the skin. In most of the cases the early sequence of symptoms appears to have been gradual and almost imperceptible indications of failing health and strength, consisting chiefly of languor and weakness, and indisposition to either bodily or mental exertion, the appetite being impaired or entirely lost, the white of the eyes becoming pearly, the pulse small and feeble, perhaps somewhat large, but excessively soft and compressible. The body wastes, without presenting extreme emaciation, or the dry and shrivelled skin usually associated with protracted malignant disease. Slight pain or uneasiness is from time to time referred to the region of the stomach, and there is occasionally actual vomiting. With every sign of feeble circulation, anæmia, and general prostration, "neither the most diligent inquiry nor the most careful physical examination throws the slightest gleam of light upon the precise nature of the patient's malady; nor do we succeed in fixing upon any special lesion as the cause of this gradual and extraordinary constitutional change."

"With a more or less manifestation of the symptoms already enumerated," writes the same distinguished physician, "we discover a most remarkable, and, as far as I know, characteristic discoloration taking place in the skin." It pervades the whole surface of the body, but is commonly most strongly manifested on the face, neck, superior extremities, penis, and scrotum, in the flexures of the axilla, and round the navel. It presents a dingy or smoky appearance, of various tints or shades of deep amber or chestnut brown; and in one instance the skin was so universally and deeply darkened as to resemble a mulatto. This distribution of pigment is not confined to the skin, but is also visible in the mucous tracts, as well as in some other structures. An interesting case occurred in the practice of Professor Biermer, of Berne (November, 1861), in a weakly girl, eighteen years of age. After

continued illness of a tubercular kind, the dark colour of the skin commenced, and increased in intensity with the decrease in the weight of the body, till death followed. The eyes of this patient happened to be examined with the ophthalmoscope, although vision was not disturbed. A bluish-black colour was everywhere visible through the sclerotic, and a peculiar pigment existed in the interior of the eye. In a plane of a uniform red-brown colour there were bluish-black spots, corresponding to the intermediate spaces of the *vasa-vorticosa,* and from which the retina was distinguished by its delicate white appearance. The disease thus originally described by Addison may be associated, like "*morbus Brightii,*" with the expression of several distinct local lesions. The discoloration consists of stains in the lining of the cheeks, and a decidedly blackish tinge of the mucous membrane of the lower lips, as if after eating mulberries. Dark areolæ become developed beneath the orbits, much marked towards the middle line of the face. In one case under Dr. Barlow, loss of consciousness and what are termed "fainting fits" were the earliest symptoms noticed (*Med. Times,* January 24, 1857).

"This singular discoloration usually increases with the advance of the disease; the anæmia, languor, failure of appetite, and feebleness of the heart become aggravated; a darkish streak usually appears upon the commissure of the lips; the body wastes, but without the extreme emaciation and dry harsh condition of the surface so commonly observed in ordinary malignant diseases; the pulse becomes smaller and weaker, and, without any special complaint of pain or uneasiness, the patient at length gradually sinks and expires. In one case, which may be said to have been acute in its development as well as rapid in its course, and in which both capsules were found universally diseased after death, the mottled or checkered discoloration was very manifest, the anæmic condition strongly marked, and the sickness and vomiting urgent; but the pulse, instead of being small and feeble as usual, was large, soft, extremely compressible, and jerking on the slightest exertion or emotion, and the patient speedily died" (Addison).

In the volume of *Guy's Hospital Reports* for 1862, Dr. Wilks has given a most able, interesting, and impartial account of the progress of our knowledge regarding this disease since the time Dr. Addison wrote. His own observations entirely uphold the argument which Dr. Addison attempted to develop; and the cases brought forward by him in that report appear to sub-

stantiate in a great measure the original facts on which Dr. Addison's history was based. Nevertheless, Addison's views have by no means received the support of the profession at large. Dr. Wilks thinks that Dr. Addison in some measure contributed to this scepticism, by including among his original cases some which did not present the true features of the disease; and the great merit of Dr. Wilks's paper is, that it more clearly defines, and renders precise, the pathological characters of the disease which Dr. Addison desired to describe. He believed, at the time he published his work, that *any disease* which affected the integrity of the *supra-renal capsules* would be attended by the remarkable phenomena originally described by him. This was an error: for all subsequent observations have shown that no recorded instance of the affection has been connected with cancer, or with any other kind of disease of the organ than that found in the genuine cases of the disease which he first described, and which constitutes the true form of the malady, as Dr. Wilks has demonstrated.

Treatment.—If the disease be recognized in its earliest stages, its progress may to some extent be delayed. The asthenia, the depression, the evidence of local irritation about the supra-renal capsules, and the pathology of the disease generally, point to the necessity for tonic treatment and nutritive diet, the avoidance of all causes of depression, and the benefit of rest in bed, and of such medicinal agents as may relieve the vomiting. Glycerine in two drachm doses, combined with fifteen or twenty minims of the spirit of chloroform, and of the tincture of the sesquichloride of iron, have been of service (E. H. GREENHOW). This may be varied by the substitution of twenty to thirty minims of the syrup of phosphates of iron, quinine, and strychnia, in place of the sesquichloride of iron. The greatest caution is necessary in using purgative remedies, as fatal collapse is apt to follow cathartic medicine.

BERIBERI, OR THE BAD SICKNESS OF CEYLON.

Definition.—*A constitutional disease, expressed in the first instance by anæmia, culminating in acute œdema, and marked by stiffness of the limbs, numbness, and sometimes paralysis of the lower extremities; oppressed breathing (anxietas in paroxysms);*

a swollen and bloated countenance. The urine is secreted in diminished quantity. The œdema is general, not only throughout the connective tissue of the muscles, but the connective tissue of solid and visceral organs in every cavity of the body is bathed in fluid. Effusion of serum into the serous cavities very generally precedes death.

Pathology and Historical Notice.—This obscure but very fatal disease is little known to pathologists in this country. Though common in various parts of India, the territorial range of its endemic prevalence seems limited in a peculiar manner. It has been chiefly met with on the Malabar coast, in Ceylon, and in that tract of country reaching from Madras as far north as Ganjam (HAMILTON). It is principally endemic in that portion of Hindostan called the Northern Circars—a province lying on the west side of the Bay of Bengal, extending from 15° to 20° north latitude. Madras, in north latitude 13° 6′, appears to be the southern limit of the disease in Hindostan. Towards the north of Madras, in the jails of Guntoor, Nellore, Masulipatam, Rajahmundry, Vizagapatam, Chicacole, Bellary, and Cuddapah, the disease is known to prevail. Towards the south it is never seen. It is said to extend from the coast not farther inland than forty to sixty miles.

It is a disease of a peculiar nature; and it has been extremely frequent and fatal amongst all the troops, both Europeans and natives, at Ceylon (CHRISTIE); and although beriberi is a far more common disease among the natives of India than among the Europeans, yet the rate of mortality is nearly twice as great among Europeans as it is among the natives. Indeed, next to cholera, beriberi must be regarded as the most fatal disease (judging of the proportion of deaths to admissions) to which Europeans in India are liable (WARING); while Mussulmans appear to be more subject to the disease than Hindoos (MALCOMSON).

Among European soldiers in India the ratio of mortality or of deaths to admissions from beriberi is above 26 *per cent.*, and amongst Sepoys it is nearly 14 *per cent.;* and large as these ratios seem, they are small compared with the ratio of mortality which obtains amongst the convicts in the Indian jails, where the *per centage* is as high as 36·5 (WARING).

A residence of several months in a district where beriberi

prevails is necessary to its development (CHRISTIE, HUNTER, EVEZARD); and the greatest predisposition to the disease exists when troops have been about eight or ten months in a settlement.

The influence of season in promoting the development of beriberi seems to be remarkable. Towards the close of the rainy season the admissions to hospitals are far more numerous than at any other period of the year: damp and moisture, combined with cold, seem very favourable to the production of the disease; and the most severe cases at Trincomalee occur during the change from wet to dry weather (RIDLEY), when a strong and hot land wind prevails, when the atmosphere is extremely dry, and when the night temperature is many degrees lower than that of the day. From August to December, when heavy falls of rain occur, with occasional sultry days, and when the alternations of temperature are at the greatest, and the exhalations the most concentrated, then the admissions to hospital for beriberi are the most frequent (WRIGHT).

The name *Beriberi* was given by the Malabar physicians, and has been handed down to us by writers on Indian diseases as a name for almost every fatal disease of debility: paralysis of various kinds, reflex paraplegia, dropsy, anasarca, cachexia, scurvy, and anæmic rheumatism, with various diseases of the heart and pericardium, have all at some time been included under the common name of *beriberi*. It is therefore necessary to give to the term some degree of precision, by a definition which will embrace the leading phenomena of this remarkable disease.

The majority of the phenomena which characterize the well-recorded cases of this disease are undoubtedly referable to *anæmia*. The debility, the cold extremities, palpitation, dyspnœa on exertion, frequent, small, and quick pulse, the bruit occasionally heard in the neck, the scanty urine, the torpid bowels, the deadly pallor of the tongue, all indicate a condition of anæmia (EVEZARD). The disease makes its advances in an insidious manner, as all forms of anæmia do, without any primary or well-marked train of symptoms; and the indisposition appears to be comparatively slight which exists as a stage precursory to the visible invasion of the fully expressed disease (WRIGHT, EVEZARD). The approach of the final and characteristic features of the disease appears to be very gradually brought about, a constitutional state or diathesis is gradually established, and a form of anæmia sets

in, combined with the cachectic dropsy of Andral—a condition allied to that of chlorosis in the female (Evezard). Many of the more early observers of the disease concur in regarding the fully expressed phenomena of beriberi as the result of exhaustion and debility (Farrell, Dick, Ridley).

Morbid Anatomy.—More or less fluid is found in one or all the cavities of the chest; most commonly in the pericardium. The areolar tissue of the heart is in some instances loaded with fluid; and hypertrophy of its substance is not unfrequent. The areolar substance of the lungs is loaded with water; likewise the substance of the brain. The ventricles contain an increased amount of fluid; and fluid is effused over the surface of the brain.

The abdominal cavity and the general connective tissue of the body abound in fluid. In general, it may be said that in every case examined after death serous fluid in one or more cavities was found to exist; and the pericardium alone, or in conjunction with some other cavity, was the seat of effusion in above 83 *per cent.* of the cases—the quantity of fluid varying from two ounces to a pint. The spinal cord is variously altered, either by minute effusion of fluid into its substance, or by congestion of its vessels, thereby accounting for the phenomena of paralysis. The unsteadiness of gait and the paralysis of the lower limbs may be also in some measure explained by the mechanism of the spinal canal, combined with the presence of serous effusion in its connective tissue. When it is remembered that the spinal cord more completely fills the vertebral canal in the dorsal region than it does either above or below, it will be understood how symptoms of compression from serous effusion will most early manifest themselves by paralysis or unsteadiness of gait in the lower limbs. The kidneys have been found enlarged, softened, and anæmic; the heart is generally found enlarged, pale, flabby, and softened; the lungs are œdematous, and serous effusion into minute connective texture is the only uniform appearance which exists in every case (Waring).

Symptoms.—Like rheumatism and gout, the disease expresses itself under several forms, of which three may be noticed, namely:—

1. The *acute, severe,* or *inflammatory form* of this disease is generally the culmination of the constitutional and local phenomena in a first paroxysm. Numbness, paralysis, and œdema of

the extremities are the leading symptoms, followed by dyspnœa, and oppression at the *præcordia*. For a short time previous to any other obvious symptom, the patient, though robust-looking, may not have been able to exert himself in consequence of the partial loss of the use of the lower limbs. This rapidly increases, till he finds that there is inability to walk, accompanied with œdema of the extremities, which very soon passes into general anasarca, affecting the innermost recesses of the textures—if such an expression may be permitted. Febrile symptoms are associated with this acute or arterial anasarca. The skin is hot and dry, the urine is scanty and high-coloured, the bowels are costive, and the stomach irritable. There are rapid and full pulsations of the large arteries, while the pulse may be variable at the extremities, accompanied generally with dyspnœa and symptoms of effusion within the chest. In other cases there may be headache, restlessness, and delirium, with a slow and full pulse, indicating serous effusion and pressure on the brain. When the œdema is general, and becomes rapidly developed, the condition of the blood is changed from its anæmic character. It becomes dark and ropy, resembling in some degree the appearance of the blood taken from a patient affected with cholera (WRIGHT).

2. In the *second, the asthenic,* or *chronic* form of beriberi, the patient is very often more or less worn out by some previous disease; or he may have had a previous acute attack of beriberi, of which there may be a relapse; and it appears that men in whom the disease has once manifested itself are the more subject to future attacks (CHRISTIE), for it is found that one attack predisposes to another (WRIGHT); and then the dropsical symptoms more generally resemble those observable after protracted fevers or other debilitating causes. Abdominal dropsy is most prevalent, accompanied with symptoms of general relaxation—a small and quick pulse, constipated bowels, scanty urine, loss of appetite, universal œdema, much pitting on pressure, and paralysis of the extremities.

The heart partakes of the general debility. It is flabby, and the venous circulation becomes retarded. Soon, perhaps, it dilates, when a temporary bellows sound may be heard. After several such attacks and recoveries the heart becomes thickened, and hence we have the *post-mortem* appearance of either a large and flabby heart, or of one eccentrically hypertrophied (EVEZARD).

3. In the *third* and *mildest form* of the disease the patients are first attacked with some stiffness or rigidity of the legs and thighs, succeeded by numbness, slight œdema, and sometimes paralysis of the lower limbs. The œdema is in general limited, with slight pitting on pressure. There is no unnatural heat of skin; the pulse is seldom above the natural standard; the urine is scanty; and the appetite unimpaired. There may be occasional palpitations of the heart, with costiveness, blanched conjunctivæ, flabbiness and paleness of the tongue, and whiteness underneath the nails. Although such patients generally say that they are well, they will sometimes acknowledge a slight feeling of numbness and coldness of the extremities—symptoms which would readily disappear under appropriate treatment; but after a close night, with either a fog or a shower of rain, such a patient would apply for medical aid in the morning, with a scarred aspect, sighing breathing, violent palpitation of the heart, sometimes with a diffused impulse, pain in the præcordial region, and a variable, fluttering pulse. In such cases there are also dyspeptic symptoms, with acid eructations and puffiness of the stomach. The scanty and high-coloured urine has an acid re-action when voided, shows a specific gravity of from 1025 to 1040, and contains an excess of urea. It is such cases which are apt *suddenly* to become aggravated, and to pass into the acute form of the disease. The œdema then progresses from the lower limbs to the hands; the throat becomes swollen, and the face bloated. A sense of numbness is experienced round the mouth, and a general sense of numbness is experienced all over the body, particularly over the extremities, which appear to be unusually weighty and rigid (hence, when walking, the gait is unsteady). The urine, secreted in diminished quantity, is extremely hot when passing through the urethra; and as the disease progresses, a total suppression of the urine generally takes place. A sense of pain and tightness is felt immediately beneath the inferior edge of the sternum, which sometimes becomes so distressing as to induce the patient to solicit that the part may be cut open, hoping to relieve the tightness by that means. Dyspnœa becomes so urgent as to prevent the patient from lying down; heavy sighing (*suspirous breathing*) occurs, with great anxiety and restlessness. The lips and tongue may now be seen to be livid, and the extremities become cold (Ridley).

Universal debility, extreme prostration, anxiety, dyspnœa, numbness, œdema, anasarca, and paralysis, are the most characteristic phenomena of the disease. And in some instances, when those phenomena are fully expressed, the advent of the fatal event is so rapid that the patient may die within six, twelve, twenty-four, or thirty-six hours; and in other instances the disease is more frequently prolonged over several weeks. Death is in some cases extremely sudden; and from the anxietas, and the fact that obstructions sometimes occur in the veins (EVEZARD), it is not improbable that death in such instances may be due to *embolism.*

Mr. Ridley especially notices the suddenness of dissolution in most of the cases which he observed among the troops in garrison at Ceylon in 1814. "Very frequently, when speaking to one man," he says, "I have been called to another, whom I had just before left under promising circumstances, and have found him gasping, his eyes protruding, his hands clenched; and in a few minutes he was dead; and it has sometimes happened that the man I was addressing has been taken off in the same manner (*Dublin Hosp. Reports*, vol. ii., p. 234).

It is clear, therefore, that the disease cannot be referred to granular disease of the kidney with *albuminuria*, although albumen is sometimes present in the urine in a high degree, as Dr. Ranking attempts to show; nor yet with scurvy, as Dr. Morehead teaches. It seems rather to be a constitutional disease *sui generis.*

Causes.—The etiology of beriberi is but little known; but there are two points that seem well established in the history of the disease, and which must have a prominent recognition in all investigations relative to the causes which develop the disease. These points are,—*First*, The limited geographical range of *Beriberi; Second*, The fact that the morbid train of phenomena is never developed till the patient has resided upwards of eight or twelve months in the settlement where the disease is endemic.

Malaria, alternations of climate and temperature, noxious material in the waters of districts, have all been indicated as operative agents in bringing about the disease. But, looking to the fact that all the phenomena of the disease point to anæmia, it may be generally stated, that whatever tends to induce this state will favour the development of beriberi. Accordingly, the

disease will owe its origin in one place and in one person to the operation of a series of conditions which may not obtain in another place and with another person.

Mr. Christie found in Ceylon that the aged and debauched were those most liable to the disease. A great proportion of his patients were men accustomed to lead a sedentary and debauched life, such as soldiers' tailors, shoemakers, and the like; who, working at their trade, were often excused military duty, and who, by double earnings, were able to procure a larger quantity of spirits than other men.

With regard to œdema there is a great tendency, in almost every disease in Europeans, to result in serous effusions, after long residence in India. Indeed, Sir Ranald Martin observes, in his admirable introductory chapter to the second part of his great work on the *Diseases of Tropical Climates*, that of all conditions incident to tropical invalids, anæmia is the most common. With regard to some places—such, for example, as Masulipatam (where *beriberi* abounds, in the jails especially)—it has been observed by Mr. Evezard that *œdema* is frequently one of the latest symptoms of *anæmia* outside the jail. He also observes that anæmia appears to be almost the normal state of about a third of the population, particularly the higher castes—a circumstance which he states is partly due to the constitution of the Telugoo, and partly to the eliminating power of the drinking-water, which contains so much of *chlorides* and no *iron*. The natives are well aware of the effects of the brackish water which the majority of them are obliged to drink at the end of the rainy season; and when they find themselves suffering from the anæmia, they procure water from Goodoor, a village about six miles due west of Masulipatam. The water at Masulipatam seems to abound in saline material, such as chlorides, lime, magnesia, and a trace of alumina and iron, in the form of a carbonate (EVEZARD).

The sanitary condition of prisoners in jails are, it is presumed, much worse than the free population outside. The criminals in the jails of India have just sufficient food to keep them alive, and scarcely variety enough. They have not sufficient food to store up for fat or warmth, and none of those luxuries which are supposed to check waste of tissue, such as tea, coffee, tobacco, betel, and the like; and they have not sufficient cloth-

ing, many of the prisoners having only one cloth. Mr. Evezard, however, considers that the persistence of the anæmic state is more due to the damp and foul atmosphere of unventilated cells than to food. The soil is for the most part salt. The water of the tank in the jail compound is salt, and its recession leaves a wide margin of saline substance in the soil, which re-attracts moisture like a cloth that has been wetted in sea-water, and which afterwards retains and absorbs the moisture. The *chunam* and mud of the jail walls, and the walls of the cells too, are salt; and in the morning they may be seen dripping with moisture, even in the dry season.

Since improvements have been made in drainage, and since the introduction of a mass of iron, which is allowed to rust and corrode, into each *chatty* of water used by the prisoners for drinking and cooking, not a single case of beriberi has occurred during the wet season. It is lying on the wet ground in wet weather which, Mr. Evezard believes, brings on beriberi among Sepoys who have previously rendered themselves predisposed by voluntary starvation.

Under conditions such as these, it is not difficult to understand how a state of ill-health is insidiously established, during which period some *inbred* morbid material is developed in the constitution, which at last produces the phenomena of beriberi when certain endemic circumstances favour the full expression of the disease.

Diagnosis.—The most uniform phenomena in the fully expressed disease is the characteristic numbness of the surface generally, and the paralytic affections of the lower extremities which accompany all the forms of the disease. The disease has been confounded with the *barbiers*—a chronic disease in which paralysis, tremors, spasms, contractions of the limbs, and emaciation are the most remarkable symptoms. Some, however, are inclined to regard the acute or first form described as the true *beriberi*, while others consider the second form described as the disease known by the name of *barbiers*. It is admitted, however, that the one is often associated with the other, either of them being the primary affection, for cases commencing in the form of *barbiers* often suddenly take on the more fatal and acute form of *beriberi*, while the latter frequently presents the symptoms characteristic of the former (Malcomson). The two classes of cases prevail in the same places, seasons, and circumstances, and require the same treat-

ment. It is therefore more consistent to consider the disease under the three forms described in the text.

The Prognosis is generally unfavourable, the disease approaching insidiously, the anæmia and constitutional state having often advanced so far as to be beyond the reach of repair. A temporary recovery may be established, but relapses are frequent and convalescence is lingering. A first attack generally leaves unpleasant phenomena behind. In the case of Mr. Ridley, a surgeon of the Royal Artillery, who wrote an excellent account of the disease as he saw it in Ceylon, and who suffered from it himself, the memory became considerably impaired, and an extraordinary fluttering of the heart, almost producing faintness, occurred at intervals after convalescence was established. Violent palpitation succeeded, which, on subsiding, left extreme lassitude and faintness; and when these phenomena first occurred, a violent beating of the carotids came on; and when this rapid pulsation ceased, he was left so extremely weak and languid as to excite considerable apprehension of a fatal result.

In all cases of *beriberi* a *suddenly* fatal result may be apprehended at any period after the full expression of the phenomena, probably from *embolism* or *cardiac affection*. The symptoms which denote danger are general œdema, much *anxietas*, and palpitation of the heart, the respiration becoming more quick as the fatal termination approaches. It is laboured, quick, and interrupted with sighs and groans, the pulse becoming weak and irregular at the extremities, with palpitations of the heart. If coma or delirium supervene, a fatal event may be expected. Much nausea, obstinate costiveness, a dry and black tongue, are all symptoms of danger. The prognosis is more favourable if the œdema sets in very gradually, and is confined to the lower limbs, when the skin is moist and moderately warm, when the patient enjoys sleep, and when the principal natural functions are unaffected.

Treatment.—*Bleeding* has been considered applicable to those cases where there is extreme difficulty of breathing and delirium, when the patient is robust, and when the œdema does not pit much on pressure, where there is rapid and full pulsation of the large arteries, and if the urine shows the existence of albumen (Wright); but, judging from the pathology of this disease, the con-

stitutional influence of stimulants, of generous diet, and of tonics, ought undoubtedly to be the basis of treatment. Should there be irritability of the stomach, the effervescing draught with doses of laudanum and camphor mixture are useful. Saline drinks should be administered, and the extremities should be rubbed with stimulating liniments and rolled in flannel bandages. In the *asthenic* or *chronic* form of the disease the strength must be supported by the most nourishing diet that can be given in small bulk, aided by tonics, and wine if necessary; while doses of equal quantities of *squill* and *digitalis* (ten to fifteen drops of each) may be given twice or thrice daily. In the *third* and mildest form a native remedy called *Treeak Farook* is very useful. The ingredients of this medicine are unknown. It is known to have been prepared in Venice, and transmitted to India through Arabia, and was first recommended by Dr. Herklotts, of the Madras Presidency, as a remedy in beriberi. It is a thick extract (in which some terebinthine material largely enters), which is only to be procured from the Moghuls, and in those towns which still keep up some communication with the Arabian Sea. Many observers bear testimony to its good effects in removing the œdema and subduing the pulse (WRIGHT, TRAILL, GEDDES, MALCOMSON). In some recorded cases the pulse has fallen in four days from 108 to 84 beats per minute under its use.

The prescription most approved of consists of the following ingredients:—

℞. *Treeak Farook*, ʒiii.; Pulv. Rhei., ʒiiss.; Pulv. Cinnam., ℈ii.; Pulv. Caryophylli, gr. xxi.

These ingredients are to be made into a mass or *electuary* with honey, of which four scruples and a half are to be taken every morning (GEDDES), with more honey, or in divided doses (WRIGHT) three times daily. The remedy does not seem to be an active medicine, and can have little power in the *acute form* of the disease. Four or five stools are obtained daily under its use, and its action is not accompanied by any violent purging, increase of pulse, or determination to the surface; and after it has been used from one to two weeks the œdema generally disappears, when the numbness and paralysis subsides.

The patient should feed on animal food, wheaten cakes, and milk.

In instances where the native remedy has failed to produce a

beneficial effect, *nux vomica* has been more successful, commencing with doses of two grains daily, and increasing the dose gradually according to the physiological result. The extract of *nux vomica*, in doses of half or a quarter of a grain, combined with iron or gentian in a pill, is the most convenient form.

Local abstractions of blood from the spine have also proved useful; and a blister applied over the loins has given relief in many obstinate cases.

No single rule of treatment will apply in all cases. The anæmic condition must be counteracted, on the principles of treatment explained under that disease; and any specially abnormal state, such as diseased heart, must be treated accordingly.

When the disease prevailed very generally in the Carnatic, in 1782 and 1783, the cases were most successfully treated by a pill containing a quarter of a grain of *extract of elaterium*, combined with *extract of gentian*, given every hour until copious watery evacuations were procured; and this plan was repeated every third or fourth day till a cure was accomplished. At another time this plan of treatment was not so successful; the cases recovering best under large doses of *spirits of nitre, antimonial wine, frictions with warm camphorated oil, aperient medicines, wine, and a nourishing diet.*

Mr. Evezard's method of medicinal treatment consists mainly in the administration of *acetate of potash* in gin, in the following formulæ:—

℞. Gin, ℥ss.; Potass. Acet., gr. v.; Aquæ, ℥iii.; *misce.* To be given three times a day. If vomiting persists, Hydrocyanic Acid may be useful in relieving it; to the extent of one drop three times a day, given in milk.

BRIGHT'S DISEASE—Syn., ALBUMINURIA.

Latin Eq., *Morbus Brightii*—Idem valet, *Albuminuria;* French Eq., *Maladie de Bright;* German Eq., *Bright'sche Krankheit*—Syn., *Albuminurie;* Italian Eq., *Malattia del Bright, Albuminuria.*

Definition.—*A constitutional affection which culminates in a variety of structural lesions of the kidneys, each of which is accompanied by the persistent separation of more or less albuminous serum from the blood, and by its presence in the urine, the connective tissue, and serous cavities of the body. The urine frequently contains blood, renal structures, exudation material,*

and desquamative renal products. The kidneys may be either large or small, atrophic or not, with fatty, or albuminous, or amyloid (lardaceous) degeneration, and altered in various ways as regards the vessels, the tubes, and the epithelium. When the constitutional disease is fully expressed there is characteristic anæmia, indicated by pallor of the countenance, a puffy face and œdematous limbs, anasarca or general dropsy, pain in the loins, with more or less albumen in the urine. Associated with these phenomena, the morbid states of the kidney may be various. There is scanty urine and frequent micturition; a sensation of heat and scalding on passing water, dryness, heat of skin, general feverishness and occasional chilliness of the surface, an irritable pulse, generally above the normal standard, emaciation, and progressive debility. Dyspeptic symptoms predominate. There is difficulty of breathing and anæmia-chlorosis. The term is generic, including several forms of acute and chronic disease of the kidney, usually associated with albumen in the urine, and frequently with dropsy, and with various secondary diseases resulting from deterioration of the blood.

Pathology.—In Bright's disease, as with all the constitutional diseases, an undue share of attention has been bestowed upon the prominent local lesions in which the existence of the constitutional state has finally culminated. For example;—the anatomical characters of *tubercle* in *phthisis*—of *cancer growths* in the *cachexia* of *carcinoma*—of the *supra-renal bodies* in *morbus Addisonii*—the *serous effusions* into the spinal and other visceral cavities in *beriberi*—of the *kidney* in *Bright's disease* and *melliturıa*—of the sediments in the urine in *oxaluria, lithiasis,* and the like, have been so prominently dwelt upon that a very narrow view is apt to be taken of the important antecedents of these diseases—of the constitutional states under which they respectively become developed, and therefore, also, of the principles which ought to guide the treatment of these respective diseases, and of the means by which their development may be prevented. A vast amount of evidence has been accumulating since Drs. Wilson Philip, Tweedy Todd, Sir James Clark, Bennett, and Ancell demonstrated how prominently the general health was impaired and forms of dyspepsia prevailed long before tuberculosis became fully expressed by the deposition or growth of tubercle; and this kind of evidence tends to show that not only are consti-

tutional phenomena characteristic of *tuberculosis* long antecedent to the expression of the disease by local lesions, but that other diseases, having similar constitutional antecedents, ought to command a more extended study from this point of view than they have hitherto obtained. *Bright's disease* and *diabetes mellitus* belong to this group.

Between 1841 and 1846 Rokitansky wrote that the nature of Bright's disease is the more obscure because the question is generally evaded. He considers that the cause of the disease is to be sought for in some anomalous constitution of the blood—to something which gives rise to a change in the blood, rather than to any specific disease of the kidney. It is this anomalous condition of the blood which must be regarded as the primary affection in Bright's disease, which, from some peculiar relation to the kidney, is followed by the secondary and visible disorganization of the renal tissue. The constitutional origin of the disease is also shown in the fact that both kidneys generally express the local lesion about the same time, or with a brief interval.

It is now nearly nineteen years (1849) since Dr. Walshe, the Emeritus Professor of Medicine in University College, published a commentary on a clinical lecture, in which he taught that Bright's disease was not essentially a renal disease, but essentially and primarily a blood disease (*Lancet*, July 14, 1849). Since that time he has maintained the same view regarding the pathology of this disease; and there seems to be now an abundance of facts and arguments to establish its correctness. The conclusions to which Dr. Walshe arrived were mainly these: —That from the very commencement Bright's disease is a general disease of the blood; that the renal textural changes are not the cause of the phenomena comprehended under the name of Bright's disease; and that the local lesions which occur in the kidney do not even furnish any measure of the intensity of the characteristic phenomena of Bright's disease; that the textural changes in the kidney are in reality the local expression of the constitutional state, just as tubercle is of tuberculosis; that the primary constitutional and blood changes are probably due to a morbid condition or direction of the primary and secondary digestion processes; and that Bright's disease is thus recognized as one of the typical *diathetic* or *constitutional* diseases.

Some of the more eminent pathologists and discriminating

physicians of the day take a similar view of the essential nature of Bright's disease. Mr. Simon writes that it "depends on some humoral derangement of the entire system, and (the subacute inflammation of the kidney) commences as functional excitement, manifested in an act of over-secretion. The *materies morbi* seeks to effect its discharge by means of an increased activity in the secreting functions of the kidney: it stimulates it; and the result of the stimulation is not so much an increase of the watery secretion as it is an augmented cell-growth in the tubules of the gland. This acceleration of function is incompatible with the maturity of the secreted products; the epithelial cells undergo various arrests or modifications of development, and become more or less palpably imbued with evidences of inflammation."

Dr. Johnson teaches the same doctrine. He shows that the morbid states of the kidney found in Bright's disease "are often mere local manifestations of a more general constitutional disorder;" and Dr. Watson concurs with him in the belief that "it is the quality of the blood sent to the kidney, and not its quantity, that determines the renal disease."

The very interesting experiments made by Dr. Parkes (*Med. Times and Gazette*, 1854, p. 394) regarding various phenomena in Bright's disease, tend to strengthen the view of its constitutional development, more especially when studied in connection with the observations and experiments of Lehmann, Bernard, and Pavy in relation to the excretion of a substance by the liver, and the formation of sugar in the blood when that substance comes in contact with albumen. Bernard's researches have shown that the blood which leaves the hepatic vein contains a peculiar substance (saccharine?) which does not exist in the blood brought to the organ by the portal vein; and Pavy, of Guy's Hospital, has demonstrated that the liver does not form sugar, *but a substance that becomes sugar* almost immediately upon contact with albuminous matters. It is this material (as Dr. Carpenter writes) which is especially destined as a *pabulum* or fuel for the combustion process, being usually eliminated from the blood in the form of carbonic acid and water, during its passage through the lungs, so as not to pass into the systemic circulation, unless its quantity be either unusually large or its elimination be interfered with by imperfect respiration. This substance appears

to be mainly elaborated by the converting power of the liver, either from materials supplied by the food or from the products of the waste of the system (*Animal Physiology*, Bohn's edition, p. 308). Now, both of those conditions obtain in many cases of Bright's disease, if not in all. The condition of the urine before and after food is a point which has been in a great measure neglected till Dr. Parkes showed its importance in cases of this affection. In many cases of persistent albuminuria with renal casts and anasarca (not dependent on heart disease) the albumen in the urine is augmented after food.

But apart from the albumen excreted, Dr. Parkes found that the solids excreted were greatly increased. A weak, thin, quiescent man gave off daily 981 grains of non-albuminous solids, whose average in health did not exceed 650 to 750 grains. It has usually been considered that in chronic Bright's disease the non-albuminous solids are diminished (CHRISTISON, FRERICHS, JOHNSON); but according to Dr. Parkes this rule has numerous exceptions. To detect the increase of the solids, ALL the urine passed during the twenty-four hours must be collected and examined. It is then found that the urine is of low specific gravity, but so copious that the total amount of solids in it is very great. Such cases are found to be constantly feverish—not so much so as to be detected by the mere heat of skin as felt by the hand; but the thermometer under the axilla will show that the temperature of the body is uniformly more than a degree and a half above the healthy standard of 98° Fahr. Thus the thermometer will delicately indicate and explain how an increased metamorphosis of tissue is going on in such cases; and observing such an increase among the urinary non-albuminous excreta, it may be concluded that they are partly due to increased disintegration of tissue; and, as Simon writes, "the morbid material which thus stimulates the kidney in its struggle for elimination will sometimes consist of products of faulty digestion (*e. g.*, lithates, oxalates); sometimes of matters cast upon the kidney in consequence of suppressed function in other organs (*e. g.*, the skin, the liver); sometimes the mysterious ferment of a fever poison (*e. g.*, typhus, scarlatina, typhoid fever)." This view of the subject and method of investigating cases of Bright's disease, as well as of other wasting diseases, is not sufficiently practised and studied by the student of medicine; and it will be found, as Dr. Parkes has

shown, that many chronic cases of Bright's disease are often really slow febrile cases, just as tuberculous cases are. In all cases of Bright's disease, and constitutional diseases generally, much may be learned regarding their nature by examinations of the urinary excretion, and microscopic characters of the sediment, in connection with the temperature of the body, the number of respirations, and the state of the pulse. The following formula may be suggested as a method for daily record of the chemical composition of the whole urine passed during twenty-four hours in such cases; and if chemical and microscopical examinations of the urine are made from day to day, and carried on continuously, the particular morbid state of the kidney associated with Bright's disease may be probably or approximately ascertained:—

Date.	Quantity in cubic Centimetres.	Specific gravity.	Solids (in grains).	Urea.	Albumen.	Sulphuric Acid.	Phosphoric Acid.	Extractives.	Remarks.

The albuminous character of the blood after meals was long ago pointed out by Dr. Andrew Buchanan, the Professor of the Institutes of Medicine in Glasgow, (*Trans. Phil. Society of Glasgow*, vol. ii.) He found a peculiar state of the blood, amounting to an appearance of leuchæmia, which immediately succeeds digestion in healthy persons, and which seems to contain numerous molecular and corpuscular elements, resembling chyle or lymph, and consisting of fat emulsionized with albumen. To this substance in the blood he gave the name of *pabulin*, and which is still further elaborated in the blood, in the glands, and in the lungs. The earliest notice of milky blood is that in the *Philosophical Transactions*, No. 6, p. 100.

During the processes of digestion in the stomach, albuminous substances are known to undergo extraordinary changes; and during the transit of the blood through the liver, the fibrin and albumen undergo still further modification, so that 30 *per cent.* of the albumen entering the liver in the portal vein disappears

in that organ, and is not to be found in the blood of the hepatic vein (LEHMANN). Thus the liver is known to exert an overwhelming influence on every digested aliment which enters it, and the influence which it exercises over albuminous aliments is not the least important (PARKES). Again, if crude albumen is taken and introduced at once into the circulation, as Bernard has proved by experiment, through the jugular vein, it is incapable of assimilation, and is rapidly excreted in the urine, a temporary albuminuria being thus produced. In the very interesting and suggestive work lately published by Dr. Basham, there are cases detailed which illustrate, upon these principles, the constitutional origin of *Bright's disease;* so that, connecting all these observations together—namely, those of Andrew Buchanan, Walshe, Lehmann, Bernard, Parkes, Pavy, Carpenter, and Basham—may it not be suggested as a topic for further inquiry (and at all events a direction which inquiry should take), as to whether or not substances usually elaborated by the liver are not arrested in Bright's disease, or that the liver is insufficient to use up the albumen carried into the blood, and which therefore comes to be eliminated by the kidney? The inference at any rate now presents itself; and, as Dr. Parkes writes, "May it not be possible that, by some failure in preparation, either by the stomach or liver, albumen enters the blood of the right side of the heart in a still crude state, and in a condition similar to that in which it would have been had it been introduced through the jugular vein? and thus, being unassimilatable, is it not excreted, as in Bernard's experiment, by that ready outlet, the kidney? In support of such a supposition," continues Dr. Parkes, "we have the facts, that many cases of kidney disease seem to be most probably of blood origin, and that among the common antecedents of Bright's disease are circumstances of diet or mode of living which would be likely to impair the processes which should go on in the stomach or liver. In how many cases of Bright's disease have dyspeptic symptoms been present for a long time before renal signs have shown themselves? In how many other cases are signs of liver diseases coincident with the renal signs? In how many *post-mortem* examinations, although no liver disease has been suspected, do we find evidence that for a length of time the structure of this organ has been seriously diseased? In the history of Bright's disease there are many

reasons for believing that the nutrition of tissues is early and deeply affected."

The renal engorgement is certainly not the first in the order of morbid change: it is secondary to more remote morbific action, pervading the system throughout. An altered, defective, or contaminated state of the blood is the source, in all probability, of the morbid phenomena which follow. A careful inquiry into the antecedents of patients suffering from Bright's disease will exhibit the predisposing causes of their failing health; and these will ever be such as exercise a marked influence over the quality of the blood, rather than such as have any special reference to the kidneys. The most frequent and patent of these predisposing causes are habits of intemperance, inducing an alcoholized state of the blood; the various febrile poisons, particularly the scarlatinal; a scrofulous habit of the body, or the tuberculous constitution (BASHAM). We see here a wide field for future exploration, especially in discriminating the forms of dyspepsia or of ill-health which precede these cases, and which are frequently to be seen among the wandering, uncertain crowds who frequent the outdoor or dispensary practice of our large city hospitals. In the morbid anatomy of Bright's disease, and diseases generally of constitutional origin, the glandular structure of the stomach and intestines, as investigated by Handfield Jones, Schäpfer, Habershon, and Fox, promises to yield important results in connection with the early history of such cases.

The disease is sometimes classed under "Diseases of the Urinary System;" and considered under two forms, namely,—(1.) *Acute Bright's disease,* of which the synonyms are, "*acute albuminuria,*" "*acute desquamative nephritis,*" "*acute renal dropsy;*" (2.) *Chronic Bright's disease*—Syn., "*chronic albuminuria,*" with the following subdivisions:—(a.) *Granular kidney*—Syn., *contracted granular kidney, chronic desquamative nephritis;* (b.) *Gouty kidney;* (c.) *Fatty kidney;* (d.) *Lardaceous kidney*—Syn., *amyloid disease, waxy disease.*

Nomenclature.—The disease has been named after the eminent physician of Guy's Hospital, who, in 1837, first drew the attention of the profession to the connection which he observed to subsist between certain forms of anasarca and lesions in the kidneys. It has of late been most extensively investigated by Christison, Frerichs, Ringer, Walshe, Parkes, Gairdner, Wilks, Goodfellow,

Basham, and others. The questions which the subject opens up in pathology are of extreme importance. The disease has been termed "granular degeneration of the kidney" by Christison; but looking to its pathology, and to what is now known regarding the morbid anatomy of the kidney in this disease, perhaps it is better designated by the name of the distinguished physician who first described the more prominent phenomena of its course.

Symptoms.—It is necessary to inquire into the history of each particular case, so as to ascertain the precise period, if possible, when the general health began to be impaired; and in order to determine the particular morbid condition in which the kidney exists, it is necessary to make a chemical and microscopical examination of the urine from day to day, determining especially those points which have been enumerated in the preceding section.

The general symptoms which are indicative of the several diseases or states of the kidney comprised under the general term "Bright's disease" have been recently analyzed and admirably described with great care by Dr. Goodfellow, Lecturer on Medicine at the Middlesex Hospital. They may be comprised under the following heads:—

1. Although the anasarca or general dropsy, either or both of which are usually prominent symptoms when a patient with "Bright's disease" seeks medical advice, yet in nearly every instance they have been preceded by other phenomena more or less definite—*e. g.*, febrile excitement, a dry and harsh state of the skin, a quick and hard pulse. It is only in the acute cases that the prominent and characteristic phenomena of anasarca come on with great rapidity, and commence generally with puffiness of the eyelids, or of the whole face, rapidly extending over the rest of the body. In the more chronic cases the œdema generally commences in the lower limbs; and it is at the same time associated with a pallid condition of the eyelids, and of the looser connective tissue of the face.

2. Anæmia is another prominent phenomenon. It is indicated by the pallor of the surface of the body and of the countenance. Its progressive appearance may even suggest a suspicion of renal disease before the anasarca sets in, especially in patients above the age of from thirty-five to forty, and whose urine ought therefore to be at once examined.

3. Pain in the loins may or may not be a sign of significance.

Lumbar pains may be considerable in amount, and yet no renal disease may be capable of detection at the time. In most cases no unpleasant sensation is felt in the lumbar region till the anasarca becomes considerable.

4. In the early stages of the affection there is always a very considerable diminution in the quantity of urine passed. But there are many exceptions to the rule, and in some cases the urine is more abundant than usual—*e. g.*, Parkes has measured more than 100 ounces; Rosenstein (quoted by Parkes) relates a case where an increase of 174 ounces was passed daily during eight days. Various circumstances concur in determining the greater or less amount of water passed. (See under "Amyloid Degeneration," vol. i., p. 131).

(*a.*) The anatomical condition of the kidneys influences the amount, and especially with or without anæmic symptoms. The mean of *six* cases without anæmic symptoms gave 61·5 ounces daily. The mean of *four* cases with uræmic symptoms gave thirty-eight ounces daily, the specific gravity in both sets of cases being very nearly the same (PARKES). There is some reason to believe that, in the highly atrophic kidney, when many vessels are obliterated, the urinary water is on an average lessened; but yet on some particular days a large quantity may be excreted: for example, Dr. Parkes has known as much as *sixty ounces* passed in one day by a kidney under such a condition.

(*b.*) The co-existence of dropsy with anæmia in an advanced period of the disease appears to be associated with lessened water; while, on the other hand, an improvement in dropsical symptoms is attended by more or less profuse diuresis.

(*c.*) In a few cases the amount of urine is influenced by the presence or absence of fever. The quantity is very much smaller in amount on fever days as compared with fever-free days.

(*d.*) Organic lesions of the liver, heart, and lungs may either cause lessened rapidity of flow through the renal vessels, or give rise to great variations in lateral pressure.

(*e.*) One of the main causes of a variable amount of water is the spontaneous purging or vomiting which sometimes takes place, and which would lessen the amount of urine; while, on the other hand, lessened skin exhalations will increase the flow.

Until the metamorphosis of the nitrogenous tissues in Bright's disease is better understood, the question as to the possible

lessening of *formation of urea* and *uric acid* must remain undecided. Hitherto lessening of these products seems to have been the rule, to which, however, there are numerous exceptions (PARKES); and on the whole it appears probable that the effect of *a febrile* Bright's disease on the ordinary urinary constituents is chiefly owing to the physical condition of the kidney. There is no doubt that urea in the blood is increased, and it seems pretty clear that the urea in Bright's disease is still formed to a considerable amount, and that its lessening in the urine is in part owing to *retention* from simple impediment to diffusion through the diseased renal vessels and tubes; but it is yet undecided whether or not there is at the same time a *lessened formation* of urea (PARKES).

The principal abnormal constituent of the urine in Bright's disease is dissolved albumen, which exists in various conditions, and gives different re-actions with the usual tests, heat and nitric acid. Sometimes it entirely coagulates, and is precipitated by heat and a moderate quantity of nitric acid; at other times, after precipitation by heat *from an acid urine*, it is entirely re-soluble in a moderate amount of nitric acid. A very minute quantity of nitric acid will also sometimes prevent its precipitation by heat, while on the other hand it is sometimes precipitated by nitric acid, and not by heat (various authorities quoted by PARKES). Its most usual condition, however, is that in which it is precipitated by heat from a urine which is naturally sharply acid, or which has been made so by a moderate quantity of nitric or acetic acid.

Of the apparently anomalous phenomena just described, the following explanation is given by Dr. Parkes:—"When albumen is experimented with, it can be made to pass through various phases of solubility and insolubility, from the actions of acids, alkalies, and salts, without its real nature or composition being in any way altered; and as such influences will act on it more or less in every urine, it by no means follows, when the albumen in the urine of Bright's disease presents modifications in its re-actions with re-agents, that it is in any very peculiar or unusual condition" (*On the Urine*, p. 390).

The amount of albumen varies much, ranging from 5 to 545 grains in the twenty-four hours (PARKES); and in any particular case the amount varies greatly from day to day. It is often increased during the day, from movement or from food; and Dr.

Parkes has noticed it very greatly increased in the second and third hours after dinner. The phenomena, however, is not constant, nor does it occur in acute cases of Bright's disease: though passed, it is often in a peculiar condition, being less perfectly coagulable by heat, and sometimes approaching in character the *albuminose* of Miahle. The albumen does not always increase as the disease advances; on the contrary, while there is a tendency to a larger excretion of albumen in the early stages of the disease than in the later ones, and while sometimes even at the last there is much albumen, yet it is sometimes entirely absent in the later period of the disease. In a certain number of cases the albumen may disappear from the urine; but it is important to notice that the detachment of fibrinous casts goes on even when the albumen has disappeared.

In small quantities fat is very common in the urine, derived directly from the kidneys. It is usually in the form of *oleine*, mixed up with albuminous substances, or contained in the epithelial or other cells, and microscopically visible; and it must be remembered, as Dr. Johnson was the first to determine, that some of the secreting or epithelial cells of the kidney enclose a minute quantity of fat, just as in the secreting cells of a healthy liver, as shown by Bowman.

In the more advanced stage of chronic Bright's disease, instead of the urine being scanty in quantity and having a tolerably high specific gravity, the urine passed in twenty-four hours may amount to from *thirty-five* to *fifty* ounces or more, being equal to, and in some cases greater than, the average in health. The specific gravity is nearly always below the healthy average, the urine pale, and in very advanced cases almost colourless. Occasionally it may be red, reddish-brown, pale smoke-brown, or "smoky," as it is commonly described. If the urine is highly fatty, it may have a milky appearance.

Besides the albumen and other constituents of the serum of the blood, the urine may contain blood-corpuscles, casts containing blood, fibrinous filmy matters, and casts of tubes (granular, fatty, waxy, or hyaline), or simply of epithelium. A perfect acquaintance with these casts and urinary deposits is essentially necessary; for by the characters of these casts, when taken in connection with the history and symptoms, the physician is able approximatively to discriminate the morbid condition of the kidney in each particular case (BASHAM, GOODFELLOW).

The specific gravity may range from 1020 to 1025, from two causes, namely,—(1.) The presence of serum, which is heavier than urine; (2.) From the small amount of water (relatively) (GOODFELLOW).

5. There is nearly always a frequent desire to micturate, especially at night, when the patient is in the horizontal posture (WATSON), with a sensation of heat or scalding on passing water, accompanied with a discharge of mucus from the urethra, which possesses a more or less puriform character, and appears in the urine in the form of slight thin shreds (GOODFELLOW).

6. Dryness of the skin prevails, and the power of eliminating water by the skin seems impaired. Heat of skin and general feverishness, with occasional chilliness of the surface, and a pulse generally above the natural standard, are common phenomena throughout the latter stages of the disease, and when emaciation and debility are progressive.

7. *The Dyspeptic symptoms* which prevail at an early period indicate irritation of the gastro-intestinal mucous membrane. Loss of appetite, sometimes amounting to actual loathing of food, or a capricious and uncertain appetite, are amongst the most prominent phenomena. The food taken rests uneasily in the stomach, giving rise to stomachal and intestinal *pneumatosis* and acid eructations, the explosive force of the gas so generated being sometimes so great as to cause partial regurgitation of the food. Gastralgia and pyrosis may prevail; and there is very often nausea, retching, and sometimes vomiting, at occasional intervals. Attacks of diarrhœa are frequent, alternating with costiveness.

When such phenomena are discovered to exist, the urine ought to be examined at once.

8. *Symptoms referable to the State of the Blood.*—The blood in Bright's disease being decidedly watery, and the red corpuscles deficient, the stimulus of healthy blood is not experienced by the heart; on the contrary, the morbid condition of the blood impairs the action of the heart, and its circulation through the capillary blood-vessels. Palpitation is caused by very slight exertion, or by any mental emotion, and the heart beats *irritably*—the sounds being preternaturally sharp and abrupt, the rhythm disturbed, and the action irregular and intermittent. With the advance of the constitutional cachexia, the nervous and muscular structures of the heart are ill-nourished, and may become temporarily or

permanently damaged; signs of pericardial effusion may occur, or even of pericardial or endocardial inflammation. The condition of the blood varies; but (1.) There is an excess of serum, the clot constituting not more than one-fourth part of the blood. (2.) The density of the serum returns to its normal standard, or even exceeds it: sometimes, however, it remains low, even in the advanced stages. (3.) The urea disappears as the disease advances, but re-appears towards the fatal termination of the case, even in a larger amount than before. (4.) The fibrin, increased in the first stage, returns to its normal amount as the disease advances, and only becomes considerable again towards the close, especially if some of the intercurrent attacks of inflammation supervene, so common in Bright's disease. (5.) The most remarkable change the blood undergoes is the great decrease of the red blood-globules. They are frequently reduced to *one-third* of the normal proportions; and this diminution progressively advances with the disease; and, as Dr. Christison observes, "there is no disease of a chronic nature which so closely approaches hæmorrhage in its power of impoverishing the red particles of the blood." (6.) There are also present in variable, but always in considerable quantities, highly stimulating, irritating, perhaps toxic matters—pure excrementitious material—which can never be retained in the blood without more or less disastrous effects upon several great vital processes, and leading in some cases rapidly to death (GOODFELLOW). Dr. Watson is of opinion "that the renal malady has a direct tendency, by its effect upon the blood, to generate disease of the heart. It induces anæmia, and thereby debility of the muscular texture of the heart, and leads to dilatation of its cavities; and the weak muscle, becoming irritable also, grows thicker as it labours more."

The experiments of Dr. Hammond, the late Director-General of the Medical Department of the Federal Army, have proved that urea, when retained in the blood, either by disease or extirpation of the kidneys, is sure sooner or later to kill.

The blood, therefore, in Bright's disease, being poor, thin, watery, containing much less albumen, and fewer red corpuscles, than in health, and containing, moreover, extraneous offensive matters in the form of urea and the extractives—more or less urinous excrement—is ill adapted to facilitate circulation, but, on the contrary, tends to retard its progress. Ultimately the blood

is charged with further impurities. It begins to abound in fatty matter, especially cholesterin, which becomes deposited in several tissues, taking the place of their own proper elements of nutrition, and interfering with their function, as in the heart, the arteries, and the capillaries. "The body is poisoned in detail by the retention of its own excrements."

9. *Dyspnœa* is one of the earliest and most pathognomonic phenomena of chronic Bright's disease; and this shortness of breath is quite apart from, and independent of, any bronchial catarrh or disturbance in the first instance. The patient observes every now and then how short his breath has become. In an ordinary walk he finds he must stop to recover his breath. Occasionally the attacks occur at night, but chiefly during the day; and there is more or less palpitation during the paroxysms; while some wheezing at the chest may also attract the patient's notice. Weeks are thus apt to pass before the patient considers the symptoms sufficiently grave to seek medical advice (BASHAM). If the urine be examined at this early period, the presence of small quantities of albumen may be detected, and the sediment will contain granular casts, with more or less decayed cell-structures. Another cause of dyspnœa is the œdema which is apt to set in and pervade the base or more dependent parts of the lungs. It must also be remembered that the lungs, the pericardium, and pleura are organs especially liable to the intercurrent attacks of inflammation in Bright's disease.

10. *Symptoms referable to the Nervous System.*—In the absence of anasarca these symptoms are of great importance when they occur coincidently with such other general symptoms as follow anæmia or puffiness of the face. Most of the phenomena are those present in *chloro-anœmia—e. g.*, noise in the ears—a blowing or a sensation of ringing noises in the ear, occasional dimness of vision, partial amaurosis, from paralysis of more or fewer of the papillæ of the retina, giving rise to the appearance of motes or small bodies floating before the eyes (*muscæ volitantes*). In some instances there may be flashes of light from irritation of the fibres of the optic nerve. Throbbing of the temporal and other arteries, a sense of fulness or weight at the back of the head and in the nape of the neck, with a disposition to frequent cramp of the muscles of the back and sides of the neck; neuralgic pains in the face and head, or in other parts of the body; headache in

the form of *hemicrania* or *megrims;* frequent attacks of giddiness, drowsiness, disposition to comatose sleep, and in some cases profound coma, alternating with convulsions, are all premonitory symptoms of chronic Bright's disease, and may be also fatal ones. The occurrence of what are called *head symptoms* may be frequent during the course of the disease, and death of the patient is so generally preceded by *coma,* with or without convulsions, that Dr. Christison considers "death by coma" to be the "natural termination" of Bright's disease, or the mode in which it proves fatal when life is not cut short by some other incidental or secondary affection. Dr. Watson is impressed with the idea that the pale and watery condition to which the blood is at last reduced may have something to do with the stupor and coma, as in *spurious hydrocephalus* similar phenomena are seen. The disposition to giddiness is often a remarkable characteristic phenomenon. A disposition to erysipelas has also been noticed. Anasarca is one of the earliest symptoms; in ninety-nine out of every one hundred cases it is the first intimation which the physician has of the disease; but if he could see the patient regularly before this symptom sets in, there are no doubt other phenomena, perhaps less definite, which he would have no difficulty in setting down as the probable antecedents of Bright's disease.

Pallor and emaciation, if combined with anasarca, are almost pathognomonic of the disease.

Morbid Anatomy of the Kidney in Bright's Disease.—There are several different forms of lesion in the kidney associated with the phenomena of chronic Bright's disease. The several forms are distinguished by certain anatomical characters, and by more or less characteristic symptoms throughout the disease. Two at least of these forms may be considered as typical and distinct; and other forms may be recognized as a commingling of these two —modifications of them—or a mixture of these typical states together, but not to be considered as a gradation from the one form into the other. The two forms are essentially different, and never pass by any pathological process from the one to the other (WILKS, GOODFELLOW). Other forms of morbid kidney in this disease are regarded as degenerations, namely,—(1.) The fatty; and (2.) The amyloid kidney. (See page 120, vol i.)

The late Dr. Bright, the distinguished physician of Guy's Hospital (who first discovered the relation subsisting between

these morbid kidneys and certain cases of anasarca), described the disease, which now bears his name, as an affection of the kidney passing through *three* stages. Martin Solon describes *five* stages, and Rayer no fewer than *six*. More recent observers—for example, Frerichs, Reinhardt, and Chambers—recognize three stages. Those who contend for the difference of stages affirm that in the first stage the kidneys are unusually large, flabby, loaded with dark venous blood, and hardly in any respect different from what is observed in diffuse inflammation, except that externally the kidney has a granular appearance, caused by the deposition of a dark, reddish-yellow matter, which is an effusion of inflammatory products.

The second supposed stage is marked by the granular matter penetrating still deeper into the cortical substance, and which gradually increases till it invades the whole of the medullary substance of the kidney. This granular substance is of a greyish-red or greyish-yellow colour, and has in many cases something of a *cheese*-like appearance. The kidney now may be larger than natural, sometimes of the natural size, and sometimes, though rarely, diminished. Its consistency also varies; for, if enlarged, it is commonly softer than the healthy kidney; but, if diminished, it is for the most part firmer. Its colour, viewed externally, is sometimes a pale tint of the natural hue, but more commonly it is of a greyish-yellow or yellowish-red colour, and mottled. Its surface is also strongly granulated, and even rough. In this state, if the kidney be injected, the matter of the injection does not, according to Dr. Bright, penetrate the cortical portion. This is the stage in which it is considered that a complete and general metamorphosis of the inflammatory products into fat takes place.

The last stage is marked by the morbid granular deposit, which, besides invading the medullary substance, attacks the tubular portions of the kidney, so that the tubuli are often to a very considerable extent obliterated, and perhaps, with the exception of a single pencil of that structure, is entirely converted into one homogeneous degeneration. The kidneys are now, in some instances, of their natural size, but more generally they are contracted, and are smaller than usual. Their surface is lobulated, pale, and granular, resembling the roe of a salmon or the vitellarium of a bird. Their consistency also is sometimes softer and sometimes harder than natural; and Dr. Bright speaks of some

instances in which they cut like cartilage. This is the stage which leads to final atrophy and wasting of the kidney, and is no doubt that form now capable of recognition as amyloid degeneration.

In opposition to these views, which hold that *Bright's disease* is always one morbid state passing through successive stages, the observations of Dr. George Johnson, of King's College; of Dr. Wilks, of Guy's Hospital; and of Dr. Goodfellow, of the Middlesex, lead to the belief that there are two at least, if not more, great classes of disease of the kidney developed independently of each other, and associated with the phenomena of Bright's disease.

Class I.—*Forms of Lesions in Bright's Disease in which there are Productive Changes or Growth of New Material.*

These comprehend—1. *The large white kidney.* In this form the kidney varies in size to nearly double, and weighs from six to twelve ounces, or even more. Its external cortical secreting part is increased at the expense of the internal medullary or purely excreting parts. Between the base of the pyramids of a cut section and the investing capsule, an extreme case will measure from half an inch to an inch. The general appearance of the kidney is of a whitish or yellowish-white colour; it is anæmic, partly from the obliteration of the vessels, partly from more or less abundant serosity, and partly from the diminution in the amount of red blood-discs. In some parts the veins may be enlarged and turgid; in the interior of the kidney such veins are tortuous, on the surface they have an arborescent form. The medullary portion may present various degrees of engorgement, or it may be as exsanguine as the cortical part; but such extreme bloodlessness is rare. Such a kidney is flaccid.

The morbid development of this large white kidney may be traced through two stages, and if the patient lives through these two, it may be recognized even in a third stage.

If death ensues early, the kidney is found to be of tolerably firm consistence; its surface smooth, and of a more or less deeply suffused redness, very numerously interspersed with minute points of a deeper red. The capsule, a little more vascular than natural, may be easily detached. On section, the increase in size is found to be mainly in the cortical substance, which is minutely injected with blood, and presents a uniform redness, with numerous dots of a deeper red—engorged Malpighian bodies. Other red spots may be visible—due to ecchymoses. Sometimes there may be

seen portions of a lighter shade of colour, from the growth of new material. With this general state of engorgement there may be actual extravasation into the Malpighian capsules, into the tubules, and even into the intertubular substance. The pyramids are redder than natural, and the mucous membrane of the calyces and pelvis is injected. The tubes are filled with epithelium, mixed with fibrinous matter and blood, and sometimes holding together minute crystals of oxalate of lime or lithic acid. The entire parenchyma, but especially the cortical substance, is peculiarly pulpy and friable; and the surface, on section or on fracture, yields a reddish-brown slightly viscid fluid, more or less bloody, and delicately flocculent or opaque. The *materies morbi*, seeking to effect its discharge, stimulates the cell-growth in the tubules of the gland—"an acceleration of growth and of function which is incompatible with maturity of the secreted products. The epithelial cells, therefore, undergo various arrests or modifications of development. The ultimate tubules are found gorged with an uneliminable excess of crude and vitiated secretion. Blood, amorphous matter, and an infinite range of cell-growth, from pus-globules to the healthy germination of the gland-cells, present themselves in various combinations. By products such as these the tubes are plugged, and irregularly distended; and they not unfrequently burst and are annihilated. So close is the compaction of material, even in many of those tubes that have no shaped inflammatory products within them, that they are plainly impervious; and it is only by artificial means—by further tearing of the fragment, or by the use of chemical agents (under the microscope)—that we can satisfy ourselves that the dense plug in question consists of but agglomerated gland-cells" (Simon). A second or more advanced stage in the morbid development of this large white kidney may be recognized in the still greater enlargement of the organ; but the blood engorgement has subsided, the cortical substance is now paler than natural—of a whitish or yellowish-white colour. It is still more thickened or enlarged relatively to the pyramidal portion, is somewhat soft and friable, and on pressure yields a turbid milky-looking fluid. The granular material of increase is to be found almost entirely in the cortical part, both in the convoluted tubes and between them, and may be found dipping down between the tubuli of the pyramids, and separating them.

The tubes of the pyramids at the base thus present a radiated, striated, and frayed or unravelled appearance; and in the cortical substance numerous whitish lines are traceable from the surface inwards, some of which are composed of numerous isolated whitish *puncta,* while others are uninterrupted. The pyramids are of a reddish colour, of different shades in different cases. The vessels of the cortex are extensively obliterated, and the new material in this stage has undergone more or less of fatty metamorphosis. These whitish *puncta* are more particularly abundant in the superficial layer of the cortical part. They are composed of tense granules of a yellowish-white colour (Bright's and Christison's granulations), of the size of a poppy seed or a pin's head. In the cortical substance these granulations are chiefly due to the lesions in the Malpighian capsules.

Occasionally it happens that a patient may survive through these two stages of the kidney lesion, when a third stage of development may be recognized which this large white kidney will pass through. The fatty degeneration progresses; and becoming absorbed, a wasted, shrivelled, flaccid but tough kidney results.

Microscopically, the appearances of this large white kidney vary somewhat with its stage of development. The Malpighian bodies are irregular in size, some being excessively enlarged, others being smaller than natural. Their capsules are more or less distended with granular matter, and so also are the tubes. The tufts of capillaries composing the glomeruli seem wasted, and only a few large distended ones are visible. Fat-globules may also be detected, and granules of fat in extreme minuteness. In some places the tubes are empty, and compressed by intertubular new material; but in general they are greatly distended, with altered epithelium, mixed with granular matter more or less fine. Here and there a tolerably healthy capsule and tube may be distinguished close to one that has undergone the changes already noticed. The altered epithelium which abounds contains varying quantities of oil. Some of the cells are large, others are shrivelled up and otherwise imperfect in form, and all of them are more or less granular; and lines of the same granular matter may be often observed between the straight tubes.

2. *The small contracted kidney* is smaller than the normal kidney, sometimes only half, or even less than half, the natural size. It is hard, contracted, red, and granular. The cortical part

is much narrowed,—it is wasted, and almost allows the cones to touch each other; and the capsule, generally thickened and opaque, comes very near the margin of the pyramidal portion. The capsule is in general separated with great difficulty from the surface, so that more or less of the substance of the kidney is torn away with it. The surface of the organ is granular,—its substance is tough, coarse, and fibrous. The distribution of the veins on the surface of the kidney appears to determine the true shape or limits of the granulations, which are composed of bundles of tubes lying between the meshes of these veins. The blood-vessels are diminished in size, and more impervious than in the large "white kidney." It is this form of kidney which shows so well the fibrous matrix between the tubules when examined by the microscope—an appearance which some attribute to the shrunken state of the kidney, while others consider this matrix to be entirely new structure. There can, I think, be no doubt of a matrix or skeleton of connective tissue existing in the kidney, and holding its tubules together, although it may in some cases present almost little beyond a granular appearance between tubes and blood-vessels; or at all events it is extremely delicate and difficult to be seen, unless the light is well managed. This tissue becomes intensely hypertrophied in the small contracted kidney of chronic Bright's disease. A microscopic section shows the connective tissue greatly increased, and having a coarse appearance, the tubes lying side by side, and closely packed together. They are by no means uniform in appearance. Some are almost, if not quite solid, forming fibrous cords. Some are of very irregular shape, from contractions and dilatations, giving a sacculated or varicose appearance to the section. Many of these sacculated expansions being cut off from the rest of the tubule, form independent cavities or cysts. These tubules, cysts, or cavities are devoid of epithelium; and if any remain, it is imperfect, shrivelled, and granular. The walls of the tubes are puckered, and present an irregular outline (WILKS, GOODFELLOW). The process which leads to this form of kidney generally extends through many years, and is seldom found without, at the same time, a similar process having taken place in the liver or the spleen; and it is more than probable that these have been affected cotemporaneously from the influence of the constitutional cause which affects the body generally. The increase and alteration of the fibrous

element tend to induce the atrophy and destruction of the tubes and glomeruli, and at the same time there is a degeneration and actual wasting of the whole tissues of the kidney.

3. *Mixed form of kidney lesions.* There are undoubtedly cases, when the patient has been ill for a long time, in which the kidney is found presenting the characters of both forms of the lesions now described. The organs are then of ordinary size, granular, white, degenerating, and containing deposits visible to the naked eye, the processes leading to these lesions being engrafted, so to speak, the one upon the other. The kidneys are less pale than those which constitute the "large white kidney." The vessels are much more numerous, and more or less gorged with blood. The Malpighian tufts are red and solid, and the organ presents a very coarse and granular appearance (GOODFELLOW).

CLASS II.—*Forms of Degeneration which lead to Kidney Lesions in Bright's disease.*

These comprehend—1. *The fatty degeneration of the kidney.* The presence of fat in such kidneys is altogether a secondary process, and due to a change or degeneration of the inflammatory products. The renal secreting cells are found to contain distinct globules of oil or fat-granules, which obliterate all appearance of a nucleus. Little, however, is positively known regarding the formation of this degeneration as an independent form of Bright's disease; but it is a degeneration which supervenes to a great extent upon the "large white kidney," and is found more or less associated with it in every instance.

2. *The amyloid degeneration of the kidney,* associated with the phenomena of Bright's disease, constitutes the eighth form of kidney lesion which Rokitansky describes in that disease. It is the form most commonly found in patients who have suffered from constitutional syphilis or mercurialism; also in scrofulous or rickety persons. It is generally associated with similar lesions of the spleen and liver.

The nature of this degeneration has been already described in vol. i., page 120; and some of its symptoms at page 131 of the same volume.

The kidney in this form of degeneration presents but a slight increase of size, and is always considerably indurated. It is generally of a brownish-yellow colour, and the cortical substance on section has a glossy waxy look, with a glistening appearance

of the glomeruli, when the light is allowed to fall upon them in an oblique direction. The substance is usually hard and brittle, and infiltrated with the albuminous material.

Gairdner, Sanders, and Virchow were the first to discover the true nature of this degeneration of the kidney. It is the Malpighian bodies and arteries of the kidney where the degeneration seems first to commence; but it is not limited to these structures, for ultimately the tubes, epithelium, and the intertubular textures become similarly degenerate—so that in extreme forms the organ looks "as if it had been soaked in a substance like glycerine or balsam, which had subsequently hardened, and so enveloped all the tissues." The lesion seems to commence—(1.) In the loops of the Malpighian capillaries; and (2.) In their afferent vessels; and after advancing to a certain stage of degeneration, the injection of the cortical substance by means of the finest artificial injection becomes impracticable. The degenerate arteries therefore become impervious to blood; and ultimately the Malpighian glomeruli become converted into solid, homogeneous, translucent globules; and the extension of the disease to the tubes and other tissues produces at length the condition known as waxy kidney. Sometimes the degeneration commences in the capillary vessels of the *vasa recti*.

It is thus to be distinguished from the large white and soft kidney already described. It is much harder, tougher, and firmer. It is not easily torn; and its surface is uniform and smooth. The cortical substance, having a dim waxy appearance, is increased in extent, and anæmia predominates. It is this translucency, hardness, and uniformity of appearance which are sufficient characters by which to identify extreme cases; and in the more common and slighter cases the Malpighian glomeruli can be seen shining prominently like glistening grains on the cut surface. The iodine test, combined with microscopic examination, will alone, however, clench the recognition of the lesion (vol. i., p. 127). But without the application of any re-agent, the Malpighian glomeruli appear as glistening bodies, having a clearness resembling the appearance of "frosted" glass or a globule of rough ice. An excellent wood-cut of this appearance is given by Dr. Bennett in his work on the *Principles and Practice of Medicine*, p. 807, fig. 445. The capsule of the kidney is generally easily torn off; and there may be considerable loss of substance or atrophy

present, indicated by depressions or hollows on the surface of the kidney beneath the capsule. Sometimes the degeneration is so slight that a microscopic examination is necessary to detect its commencement.

Causes.—The exciting causes of Bright's disease may be enumerated under the following heads,—namely, hereditary tendency or constitution of body, age, sex, climate, occupation, habit of life, intemperance, exposure to cold and moisture, influence of zymotic disease poisons.

Intemperance, gout, and disease of the heart are the circumstances which seem to bring about the disease most frequently in advanced life. In youth and childhood the hereditary constitution of body, exposure to cold, or the effects of fever, such as scarlatina, erysipelas, measles, variola, syphilis, gout, rheumatism, tuberculosis; the indiscriminate and excessive indulgence in fermented liquors, such as alcohol, ale, stout; the ingestion of turpentine, ether, naphtha, chloroform, and the like, are the circumstances and agents which tend to that morbid state of the constitution, and that impaired state of the digestive functions which lead to Bright's disease.

A cold, humid, and variable climate is another powerful predisposing cause; although the disease is also by no means infrequent in tropical climates. These are causes which act directly upon the blood and nervous system, through the digestive and secretory functions; and which tend to interfere especially with the circulation and secretion of the kidney. The hereditary constitution of the body is of great importance. There may be such inherited weakness of constitution that impaired digestion may at once lead to the development of Bright's disease, rather than to any other constitutional disease.

There are causes, also, of Bright's disease which may be regarded as mechanical causes of irritation, but which so secondarily affect the constitution of a person predisposed to the disease that Bright's disease rather than any other is the result—*e. g.*, the irritation of blows, of cantharides, or other irritants; the presence of calculi in the kidney, the practice of onanism, or excessive venery, the existence of amenorrhœa or uterine irritation. Dr. Goodfellow points out that the influence of spirits and of beer tends each to induce a distinct variety of morbid kidney. From the action of spirits the kidneys do not enlarge, nor vary much

from the normal weight; but they become extensively granular, and full of small cysts. The cortical portion is greatly reduced in thickness, and there is much fatty matter in them.

In persons who become the subjects of Bright's disease from the excessive consumption of beer, the lesions of the kidney are generally of a mixed nature, something between the large white kidney seen after scarlatina and the true granular kidney, with more or less fatty deposit both in the tubes and in the interstitial tissue.

But while intemperance in drinking is a well-recognized cause of Bright's disease, it is not unknown among children and other persons whose manner of life has been strictly sober. Dr. Watson mentions the example of a young girl, fifteen years old, who had never menstruated, and who became affected with Bright's disease; and he remarks that the disorder has been known in many instances to follow a sudden check or suppression of the catamenia.

Diagnosis.—The specific gravity of the urine, the albumen it contains when persistent, and the amount of the solid constituents, are the first indications of the real nature of the disease. To determine the albumen, a small quantity of the urine in a test-tube must be slowly and gently heated to the *boiling* point, by the flame of a spirit-lamp, when, if albumen is present, it will appear in the form of a whitish cloud, of which the constituent particles multiply and collect, in proportion as the quantity is considerable, into small curdy fragments or flakes. These will gradually subside to the lower part of the tube when permitted to rest, leaving the supernatant liquor clear, and so indicate approximatively the amount of albumen present. A second specimen of the urine should be taken in another tube, and, after it has been thus boiled, an excess of nitric acid may be poured into the tube, when the albumen present will be precipitated in a flaky or pulpy form. This latter method is the best where the urine to be tested is alkaline; but both methods should be employed in every case; and they are sufficient to determine the presence of albumen.

The amount of solid constituents may be determined approximatively at the bedside by the following formula:—If D = the density or specific gravity of the urine, and Δ = the difference between 1,000 and its density, the quantity of solids in 1,000 grains will be = $\Delta \times 2{\cdot}33$ for diabetic urine, and by 2 for most cases. Supposing the specific gravity to be 10·20, then $20 \times 2{\cdot}33 =$

46·60, which is the amount of solids in 1,000 grains of urine; or simply multiplying the last two figures of the specific gravity by 2 for most cases, and by 2·33 for diabetic urine, will give the amount *in grammes* of solids in 1,000 cubic centimetres of urine (PARKES).

The formula of Trapp (the error of which, according to Vogel, cannot exceed one-tenth in healthy and one-fifth in morbid urine) is the best for urine *not diabetic*, and is as follows:—If Δ represents the excess of the specific gravity of urine above that of water, the amount of the solid constituents of 1,000 parts of urine will be represented by 2 Δ.

A sufficient approximation to the truth for clinical purposes is gained by such formulæ; but they can never supersede the exact processes necessary for scientific investigation (CHRISTISON).

The following table, calculated by Dr. G. Bird, according to Dr. Christison's formula, affords results sufficiently accurate for the guidance of the student or practitioner, and shows at a glance the number of grains of solids, and the weight of a fluid ounce of urine, of every density from 1010 to 1040:—

Specific Gravity.	Weight of 1 Fluid Ounce. Grains.	Solids in 1 Fluid Ounce. Grains.	Specific Gravity.	Weight of 1 Fluid Ounce. Grains.	Solids in 1 Fluid Ounce. Grains.
1010	441·8	10·283	1025	448·4	26·119
1011	442·3	11·337	1026	448·8	27·188
1012	442·7	12·377	1027	449·3	28·265
1013	443·1	13·421	1028	449·7	29·338
1014	443·6	14·470	1029	450·1	30·413
1015	444·0	15·517	1030	450·6	31·496
1016	444·5	16·570	1031	451·0	32·575
1017	444·9	17·622	1032	451·5	33·663
1018	445·2	18·671	1033	451·9	35·746
1019	445·8	19·735	1034	452·3	36·831
1020	446·2	20·792	1035	452·8	37·925
1021	446·6	21·852	1036	453·2	38·014
1022	447·1	22·918	1037	453·6	39·104
1023	447·5	23·981	1038	454·1	40·206
1024	448·0	24·051	1039	454·5	41·300

The hydræmia is indicated by the general paleness or anæmic appearance of the surface of the body; and even when no albumen can be discovered in the urine, these phenomena are of great value; and when they are observed in persons above the age of from thirty-five to forty-five the physician should at once examine the patient and his urine closely from day to day, in order that he may detect as early as possible the other symptoms and con-

ditions which are characteristic of Bright's disease. The specific gravity of the urine, the quantity passed daily, the amount of urea and of other solids contained in the daily discharge, should all be closely observed, and whether there be not slight puffiness of the eyelids in the morning, or indications of serum beneath the conjunctiva. The paleness is not a dry waxy paleness, as in chlorosis or anæmia-chlorosis. It is a paleness characteristic of dropsy.

When the disease is established, and its diagnosis confirmed, much information will be obtained as a guide to treatment, and as an aid to the diagnosis of the peculiar morbid condition in which the kidney may be, by a daily microscopic examination of the urinary sediments, as recommended by Dr. Basham in his excellent treatise on *Dropsy connected with Disease of the Kidney.*

The specific cell-characters of the sediments have been found by Dr. Basham to be a more certain guide in prognosis than can be furnished by any other property of the urine, or by any other symptom exhibited by the patient. The cell-elements associated with albuminous urine undergo marked alteration and change as the renal disease advances. Under all circumstances it is difficult to form an opinion as to the rate of progress or advance of the lesion in the kidney; and hitherto the physician has been usually guided in his prognosis by the subsidence of the dropsy, or by the diminution of the amount of albumen in the urine. The microscopic examination of the cell-elements is now recognized as yielding more certainty to the opinion which may be formed as to the progress of the renal degeneration.

The quantity of albumen present is an important point to be considered, along with the characters of the tubular or organic elements contained in the urine; and in private practice the amount of albumen passed is approximatively judged of by noting the *space* which the *coagulum* of albumen occupies in the tube after being allowed to rest. The phraseology recommended by Dr. Christison to express the proportions observed by the eye is as follows:—

1. *Gelatinous* by heat. 2. *Very strongly coagulable* by heat—nearly the whole tube. 3. *Strongly coagulable*—half the tube. 4. *Moderately coagulable*—one quarter of the tube. 5. *Slightly coagulable*—one eighth. 6. *Feebly coagulable*—less than one eighth. 7. *Hazy* by heat—no visible flakes of albumen.

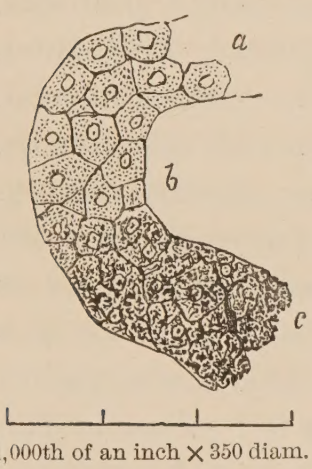
The epithelial cells thrown off from the renal tubes, as well as

the casts which accompany them, suffer very material and obvious alteration as the disease of the kidney advances. These changes consist in palpable deviations from the standard structure of healthy epithelium. The cells lining the straight tubes are the last to exhibit any character of degeneration; and in no case do the cells of the kidney-tubes appear in the urine except under the influence of disease. Any one single examination of the urine is not sufficient to determine the stage to which the disease has advanced. It is only by comparing the character of the deposit of one period with another, and noting carefully the altered appearance of the casts and cells, and the direction of whatever change is taking place, that an approximation of more or less certainty is made regarding the progress of the disease.

The sediment found in albuminous urine consists principally of cylindrical forms moulded in the uriniferous tubes of the kidney. These present different characters according to the stage of the disease or the intensity of the morbid process. They may be either coarsely granular, finely granular, or partly granular, and transparent, or completely hyaline. Associated with these casts are various cell-structures — blood-cell, epithelium-cell, compound granule-cell, and various modifications of cell-growth, as may occur during the advance of acute or chronic disease. When hæmorrhage takes place in the uriniferous tubes from rupture of the Malpighian capillaries, the coagulum formed is washed away, and appears in the urine as a cylindrical cast of a granular appearance, entangling a number of blood-cells within its mould. These casts are usually stained of a red colour by the hæmatin of the effused blood. As the hæmorrhagic state subsides, epithelial cells appear in the cast, mixed with blood-corpuscles, which gradually become less numerous, and ultimately disappear. In favourable cases the casts become more and more finely granular, and daily more transparent, and the epithelium-cells less and less abundant. In other less favourable cases various modifications of cell-development occur; resplendent granules appear, and free nuclei accompany the cast; compound granule-cells are discharged, abortive epithelial cells appear, with disintegrated granule-cells in the shape of grape-like clusters of nuclei; and other evidence of cell-transformation indicates the nature and direction which the renal disease may be taking. It is the *progressive* and day by day, or week by week, alteration of cell-

formation which accompanies the casts of albuminous urine which must be watched to ascertain the progress of the disease.

The first departure from the healthy type of the secreting kidney-cell is evinced by its becoming more granular, the single nucleus being either obscured or accompanied by other nuclear granules. The cells become larger and larger, and present a cloudy appearance; for a larger quantity of material than usual has been taken up by the cells. The entire uriniferous tubules are thereby rendered broader, and even to the naked eye such a tube looks white and opaque. The individual cells are difficult to isolate, because they adhere closely together, in consequence of the alteration of cohesion they have undergone. The few granules normally present in the cells have accumulated and multiplied in greater and greater numbers the greater the energy with which the morbid process is being carried on, so that even the nucleus gradually grows indistinct. This is the condition described by Virchow as that of "*cloudy swelling*" (trübe Schwellung), fig. 1. It is the progressive and constant increase of such compound granule-cells in the urine, or of cells becoming more degenerate and compound, with a proportionate decrease of epithelium, which is the index of advancing disease. The occurrence of such cells is usually preceded by a state of inflammatory congestion; and in proportion to the quantity of these cells, and the degree of degeneration to which they have advanced, so is the degenerative process in the kidney indicated. When groups of grape-like (botryoidal) clusters of resplendent granules appear in the urine, they are generally the nuclei of various cells, and indicate a deteriorated or atrophic state of cell-development, which eventually becomes so powerless that nothing remains but a heap of granules. These accumulating in the tubes and Malpighian bodies, eventually constitute a fatty degeneration of the whole kidney. The occurrence of such clusters in the urine is generally associated with a subacute process of disease; and when the



1,000th of an inch × 350 diam.

Fig. 1.*

* Convoluted urinary tubule from the cortex of a kidney in Bright's disease (after VIRCHOW). (*a.*) Tolerably normal epithelium; (*b.*) State of "*cloudy swelling;*" (*c.*) Commencing fatty degeneration and disintegration.

clusters become daily more numerous, they furnish very unfavourable indications. The large compound cell or inflammation-globule of Gluge never makes its appearance except as a sequel to a state of hyperæmia. There is a period in favourable cases where little or no epithelium is visible, and where transparent hyaline or waxy casts are alone seen. They are more abundant and more frequent in the chronic form of Bright's disease than in the acute; and are then present in the urine of the mildest and most tractable cases equally with the severest and most fatal. Their particular import depends on the cell-structures with which they are associated, and likewise on the relations as to time which other kinds of casts bear towards them. Although they have been named hyaline, yet occasionally they contain traces of granular matter or cell-elements. If they appear in the urine very shortly after hæmaturia, they may be accepted as indicating a state of catarrh of the renal tubes, which in all probability will prove remediable and tractable. In such cases an epithelium-cell is seen here and there in the urine, and sometimes a compound granule-cell; but these are not numerous, and do not increase. In other cases the glairy moulds of the tubes contain numerous abortive cells in almost daily increasing numbers. Compound granule-cells are then always present, clusters of granules (botryoidal or crescentic), and free nuclei are seen. These appearances are characteristic of a chronic subacute process, which progresses slowly, very insidiously, and is too often irremediable.

In a third variety of Bright's disease where these hyaline casts are seen, few or no epithelial cells are present, but the appearances are characteristic of broken-up cell-structures; clusters of granules are seen, having more and more the appearance of fat-granules. Many acquire a large size, and contain oil in abundance. In the more advanced cases the casts seem made up of these fatty and oily materials, and hence they have acquired the name of fatty or oily casts. They indicate the highest state of fatty degeneration.

There is still a fourth variety of the hyaline or transparent cast, and which, from the absence of all structure visible in it, has received the name of waxy cast. This cast may be formed either in the smaller convoluted tubes or in the larger straight tubes of Bellini. They seem to be composed of some viscid material, and become faintly granular on the addition of dilute acetic acid.

The following may be stated as a general summary of the results relative to casts in the urine in Bright's disease :—

The blood-casts represent more or less active hyperæmia and hæmorrhage from the kidney.

The coarsely granular epithelial cast, with its compound inflammation-corpuscle, and accompanied by amorphous granular flakes stained with hæmatin, represent the period of inflammatory exudation.

The finely granular semi-transparent casts, with scattered epithelium and granule-cells, represent the period of subsidence of the inflammatory process.

The transparent casts, with compound cells, or with isolated transparent molecules and grape-like clusters of granules, represent a stage of chronic subacute disease of very grave import; and if these casts become more and more loaded with large and gradually increasing fat-granules and oil-drops, the progress of fatal fatty degeneration is clearly marked (BASHAM).

Deteriorating conditions such as have been here described are not limited to the kidney in Bright's disease. There is reason to believe that the nutrition of most of the textures and organs of the body proportionally fails; and although not so apparent, because not manifested in a manner capable of being demonstrated during life, yet the tissues of every organ become more or less degenerate and inefficient for the purposes of life. The cells of the liver are invariably loaded with an abnormal amount of fat in all fatal cases of Bright's disease; and the heart-fibre and arterial textures exhibit the microscopic characters of atrophy and granular or fatty degeneration. Inflammation of the serous surfaces is a common complication.

The origin of chronic Bright's disease cannot be traced with certainty in all cases. It is one of those diseases, like phthisis, in which the patient rarely applies to the physician till the disease has made considerable advances, often beyond any remedy or means of cure. The commencement of it cannot be recalled or described by any other terms than "a gradual failure of the general health," which is usually designated as "a breaking up of the constitution." If the urine be examined at the earliest stage, the presence of small quantities of albumen may be detected, and the sediment shows examples of granular casts, with more or less decayed and broken-up cell-structure. These

phenomena often manifest themselves long before any dropsical symptoms point to the existence of renal lesions. There are also exceptional cases in which the urine at this early stage is non-albuminous.

It is important to bear in mind the relation of the hyaline, transparent, and waxy casts to the early and remediable forms of Bright's disease. In favourable cases such casts become more and more translucent; but if the disease advances, numerous cell-forms occur, and are passed along with it; and when the casts continue to present week after week a great number of free nuclei, associated with hyaline cylinders—numerous compound granular cells, some with, some without, cell-walls—the progress of renal degeneration in the most obstinate and intractable form is fatally progressing.

Without a microscopic examination of the urine from day to day it is impossible to distinguish between a case likely to improve under treatment, and one which may be viewed as hopeless; and without the daily use of the microscope the treatment becomes at the best but merely guess-work.

Treatment.—It is only the general principles which can be indicated, inasmuch as every case requires a special study, and a line of treatment in detail peculiar to itself. Whatever treatment be adopted, a long time is necessary before any appreciable results are obtained, and therefore it is necessary to persist in one line of treatment steadily from week to week, and even from month to month. It is obviously of great importance, therefore, to be as accurate as possible in diagnosis as to the probable state of the kidney, so as to define the line of treatment from the first which may seem best adapted for the individual case.

It is a question of very grave importance how far vomiting or diarrhœa ought to be checked. If either of these occurrences are suddenly stopped, the gastric and intestinal membrane acting at the time as an emunctory for the urea and other excreta of the urine, the patient may be suddenly cut off by convulsions, apoplexy, or effusion into some of the serous cavities, such as the pericardium, or the pleuræ, or the ventricles of the brain. It is necessary, therefore, in the first instance, to determine in all chronic cases the particular organ or tissue which seems in each case to be acting vicariously. The perspirations are often spontaneously profuse; and the skin is by far the safest emunctory for

the vicarious elimination of urinary constituents. Therefore it is important to promote the action of the skin if it be deficient, and to encourage it even if it is already considerable. Diaphoretics are always of essential service. The best are Dover's powder, the warm bath, warm clothing, and, for convalescents especially, a moderately warm climate. In Dr. Christison's experience they have always appeared most serviceable when they are so given as to excite a gentle perspiration during a part of the night. So it is also safe to promote the discharge of secretions from the intestinal canal, with due caution that they do not become excessive, so as to pass into permanent diarrhœa. Urea and other constituents of the urine are found in such discharges in large proportions. When general anasarca prevails, absorption may be promoted by gentle pressure, which at all times must be very cautiously applied, and the effects closely watched, for such effusions afford great temporary relief to important symptoms which indicate the involvement of vital organs. Bandaging to promote absorption is not justifiable so long as the anasarca is increasing. Patients ought to be encouraged to go about as long as they are able, care being taken that they are clothed with flannel and woollen garments, and otherwise well protected from chills or draughts of cold air.

The quantity of urea passed by the urine should be determined daily, to ascertain how far the kidneys are capable of secreting and eliminating these excrementitious products. According to the results obtained, the diet must be regulated, and such measures taken as are calculated to reduce the quantity of urea, and other constituents formed daily, to the capacity of the diseased kidneys for the work they are able to do.

In the subacute forms of the disease the action of the skin is especially to be promoted by such saline remedies as the *acetate* or *citrate of ammonia*, to which may be added *one, two,* or *three drachms of the infusion of digitalis*, and *ten* or *fifteen minims of antimonial wine.*

In such cases, also, *ten* or *fifteen minims* of the *tincture of the perchloride of iron*, or from *five* to *ten* grains of the *citrate of iron and ammonia* may be given *every day* with one of the meals. *Every second day* a dose of the *compound jalap powder* may be given: and if hyperæmia of the kidneys prevail, it may be necessary to take from four to six ounces of blood

from the loins by cupping or by leeches. As the urine becomes more free from blood-corpuscles and albumen, the iron medicines may be more frequently given, and the compound jalap powder less frequently.

A very good formula for the administration of salines and iron in the subacute and chronic cases is that given by Drs. Basham and Goodfellow. It is as follows:—

Liquor Ammoniæ Acetatis, ʒi.—ʒii.; Acidi Acetici diluti, ℥xx.—℥xxx.—℥xl.; Tinct. Ferri Perchloridi, ℥x.—℥xv.; Aquæ, ʒi.—ʒiss.; *misce*, fiat haustus.

Small doses frequently repeated seem to do better than larger ones given at longer intervals. These remedies tend to lessen the watery state of the blood; and the action of the chalybeate medicines is of no avail till after purgation has been free, and when the hot air or warm baths have caused the skin to act freely. A nutritious diet is then to be given, combined with the chalybeate remedy.

The further treatment of the chronic forms of Bright's disease is influenced by the amount of the anasarca present. If considerable anasarca is present, neither cupping nor leeches can be had recourse to, on account of the bruising and erysipelatous inflammation they are apt to induce. The chalybeate mixture already mentioned is still found of service, taken at least three times daily, and to it may be added from time to time *fifteen* or *twenty* minims of the *spiritus ætheris nitrici* (Goodfellow). The *citrate of iron and ammonia* in from *five* to *ten* grain doses, with the *sulphuric* or *chloric ether*, are also good and useful remedies; and if the iron medicines are found too stimulating, *sulphate of zinc*, or *tannic* and *gallic acids*, may be used instead. The *sulphate of zinc* is to be given in doses of *one* to *three* grains three times a day, in the form of pill, made with *extract of hop* and with or without a grain of the *extract of nux vomica*, or the same dose of *sulphate of zinc* may be given in a draught combined with *sulphuric* or *chloric ether* (Goodfellow). These latter medicines relieve considerably the flatulence and sensation of coldness in the stomach and bowels, so much complained of in such cases.

If the urine is "smoky," or if blood is seen on microscopic examination, the *gallic acid* in *five* or *ten grain* doses may be given, with a few drops of *diluted sulphuric acid* and a few

drops of the *tincture of hops*, or other aromatic vegetable tincture, in an infusion of the same. The objection to these remedies is the constipation they are apt to induce. The bowels should always be kept relaxed, two or three loose evacuations being secured daily. The medicine most generally useful is the *compound jalap powder* of the London Pharmacopœia, which should be taken in the morning fasting, in half drachm or drachm doses, in a wine-glass of water. It does not induce prostration; but by repetition it is apt to lose its effect, when *elaterium* may be necessary in small but repeated doses; *two grains of elaterium* being dissolved in *sulphuric ether*, and *the eighth part* of a grain given every six hours till the desired effect is produced. Very abundant watery purgation is thus obtained, and a sensible impression is made upon the distended dropsical parts (BASHAM).

If *elaterium* may not be deemed advisable, a saline draught of the following composition may prove efficient:—

℞. Magnes. Sulph. vel Sodæ Sulph., ʒi. to ʒij.; Ætheris Sulph., ℥x.; Acid. Sulph. dil., ℥x.; Ferri Sulph., gr. i. to gr. ii.; Aq. Menthæ Vir., ʒiii. to ʒiv.

This draught is to be taken the first thing in the morning once or twice a week. It ought to produce two or three loose and watery evacuations (GOODFELLOW).

Diuretics are a most certain and speedy remedy when the *dropsical* effusions are considerable; and they are sometimes advisable when the urine is very scanty, although they are seldom necessary in the treatment of the fundamental disease. Dr. Christison is convinced that the fears entertained by some, of injury being produced by the stimulus of diuretics on the kidneys, are visionary. In his experience, which now extends over more than forty years, the best diuretics are *digitalis, squill*, and *bi-tartrate of potash*, taken simultaneously; and, if these fail, Hollands sometimes speedily establishes the diuresis.

When dyspeptic symptoms predominate, and there is considerable flatulence, the following pill is recommended by Dr. Goodfellow to be taken twice or thrice daily:—

℞. Ferri Sulphatis, gr. i.; Ext. Nucis Vomicæ, gr. ½ to gr. i.; Mas. Pil. Galb. Co., gr. ii. to gr. iii.; *misce*, fiat pilula.

And if there be co-existent bronchitis, a draught of the *acetate of ammonia*, with *ten, fifteen*, or *twenty* drops of the *spiritus*

ætheris nitrici and half a drachm of the *oxymel of squills*, is to be taken intermediately with the pills. If much nausea prevail, *three minims* of *dilute hydrocyanic acid* may be added to the draught, with the occasional application of mustard to the stomach.

Want of sleep is often complained of, but opiates are inadvisable, because they are apt to check the secretions and to occasion constipation. *Henbane* may be given in place of *opium*.

The patient should select a residence where the soil is sandy or chalky, where the air is mild and dry, so that as much open air exercise may be taken as possible.

Diet should be light, but nutritious; no pastry should be eaten; and stimulant liquors must be used with caution, although, when exhaustion is great, their use may be unavoidable. The principal meal should be in the middle of the day, and not later than three o'clock; and the last meal should be taken two or three hours before bedtime, retiring early to bed, and rising early. Light but warm woollen clothing is to be always worn in summer as well as in winter.

The complications of Bright's disease are extremely difficult to manage.

The *diarrhœa* must not be suddenly checked. Thirty to sixty minims in water of the *spiritus ammoniæ aromaticus*, with half a drachm of the *tincture of kino* or of *catechu*, after every loose stool, will in general be all that is necessary. If there be much griping, the application of a lintseed poultice over the abdomen, with two drachms or half an ounce of *tincture of opium* sprinkled over it, will give relief (GOODFELLOW). When it is found necessary to use measures for checking the diarrhœa, means should be taken that the skin acts freely, or that the urine flows increased in quantity. Lead and opium pill (*pilula plumbi cum opio*), in doses of five or ten grains twice or even thrice a day, is the best remedy for checking diarrhœa. These remedies may be aided by a *suppository* of the *hydrochlorate of morphia* occasionally, each suppository containing a quarter of a grain of the hydrochlorate of morphia (*morphiæ hydrochlor. suppositoriæ*). Vomiting may be controlled to some extent by *bismuth*, but more frequently by *morphia, hydrocyanic acid, creosote, rectified pyroxylic spirit, chloroform*, or *chlorodyne*, or little fragments of ice; and if these fail, a blister over the epigastrium has sometimes succeeded (CHRISTISON).

Intercurrent inflammatory attacks and effusions into cavities are still more difficult complications to manage, and are very dangerous to life. The application of a few leeches, or the abstraction of a few ounces of blood by cupping, may be borne well in the head complications; but the greatest care and caution is required in the employment of similar remedies in the complication of *pericarditis*, on account of the great danger of death by syncope.

Bronchial complications are serious, and more or less constantly present; and they are frequently the immediate cause of death in chronic Bright's disease. The least stimulating expectorants may be administered under such circumstances. The following formula is recommended by Dr. Goodfellow:—

℞. Liquor Ammoniæ Acetatis, ʒii. to ʒiii.; Spiritus Ætheris Nitrici, ♏xx. to ʒss.; Oxymellis Scillæ (*Lond.*), ʒss.; *Aquæ* Camphoræ et Aquæ, ā ā ʒv.; *misce*, fiat haustus. To be taken every four, six, or eight hours.

If the expectoration be viscid, and difficult to discharge, a few drops of antimonial wine may be added to the draught; or if there be much spasm of the bronchial tubes, as indicated by the asthmatic breathing, a few drops of *sulphuric* or *chloric ether* may be given. If, on the other hand, the expectoration be purulent and difficult, a *few grains of carbonate of ammonia* may be given with the *oxymel of squills*.

Every precaution ought to be taken to prevent a fresh attack of bronchitis. So long as the patient is able to bear it, the *habit* of cold sponging and dry rubbing of the surface of the body every morning with a flesh brush or coarse towel is the best preventive, and being clad in warm woollen clothes. Flannel next the skin must be invariably insisted on.

Mercurial preparations are contra-indicated in Bright's disease—so great is the tendency to salivation and the otherwise injurious effects they produce. *Podophyllin* (the active principle of the May apple) may be used instead. Its dose is from $\frac{1}{4}$ to 1 grain; and it ought not to be given in doses larger than one grain. It is best given in the form of a pill combined with soap and hyoscyamus. As an occasional mild aperient pill, the following is also found to answer well:—

℞. Mas. Pil. Rhei. Comp., gr. ii. to gr. iii.; vel Ext. Aloes Aquosi, gr. i.; Ext. Nucis Vomicæ, gr. i.; Mas. Pil. Galb. Co., gr. ii.; *misce*, fiat pilula (Goodfellow).

DIABETES.

LATIN EQ., *Diabetes;* FRENCH EQ., *Diabète;* GERMAN EQ., *Diabetes*—SYN., *Harnruhr;* ITALIAN EQ., *Diabete.*

Definition.—*A constitutional disease obviously produced through errors in the processes of assimilation either in the stomach, in solid organs, or in the blood, and characterized especially by an excessive discharge of urine more or less constantly saccharine, excessive thirst, and associated with progressive emaciation of the body.*

Pathology.—From the time of Charles II. of England, when Dr. Thomas Willis first observed the saccharine character of diabetic urine, no disease has had its nature more inquisitively examined, and with more interesting and instructive results. The abnormal state of the urine naturally at first led the inquiry towards the kidneys. They have been industriously examined, both as to their structural and functional relations, but without elucidating the nature of the change in the urine. Dr. Matthew Dobson, of Liverpool, in 1779, first established by experiment the fact that the sweetness was due to the presence of sugar. The next step in the inquiry was the detection of sugar in the blood of the diabetic patient. Ambrosiani, of Milan, in 1835, and Dr. Charles Maitland, in 1836, obtained crystals of pure sugar from the serum of the blood, and a large portion of fermentable crystallizable syrup. The late Dr. Robert Macgregor, of Glasgow, in 1837, confirmed these observations by experiments, followed by those of Dr. G. O. Rees, of London, and Dr. Christison, of Edinburgh. Thus inquiry regarding the essential character of the disease was removed from the urine and the kidney to the blood; and research took a new direction, so as to ascertain, if possible, the source of the sugar in the blood and in the urine.

Although this disease has hitherto found a nosological place under diseases of the kidneys, the researches of Bernard, Parkes, Pavy, Ringer, and others, very clearly show that amongst them it is misplaced. If the disease is to be regarded as a local one, it should rather come under *hepatic* than *nephritic diseases;* but the weight of evidence clearly shows that *diabetes mellitus* belongs to the *constitutional* class of diseases.

The unusual discharge of urine in this malady was originally

ascribed by Mead to a morbid state of the liver and bile; but subsequently nutritive and assimilative functions connected with the digestive canal were considered by Cullen, Home, and Dobson to give rise to the morbid state. That the process of digestion and assimilation in the stomach was the source of the evil has been hitherto the prevailing theory regarding the nature of this disease. The belief received confirmation especially by the ingenious experiments of the late Dr. Robert Macgregor, of Glasgow, who ascertained that sugar was found in the stomach of diabetic patients during the process of chymification, even when no saccharine matter had been swallowed. Sugar has now also been detected in the saliva, the sweat, and in the stools. To the ingenious M. Claude Bernard, of Paris, the science of medicine is indebted for the elucidation of the nature of the normal generation of sugar in the animal economy (glycogenesis); and thus we have been provided with data for the comparison and study of its morbid generation in *melituria*. He has shown us that one of the natural functions of the liver is to generate sugar, and thus the sagacious speculations of Mead, which referred the phenomena of diabetes to a morbid state of the liver and bile, are now not only curious, but interesting and instructive. While our knowledge regarding the formation of sugar by the liver, and its physiological relations to the animal economy in health and in disease, have been especially illustrated by Bernard, in France, it is to be observed that Dr. George Harley, of University College, and Dr. Pavy, of Guy's Hospital, London, have confirmed many points, and especially elucidated the interesting doctrines of Bernard. Much is still unsettled as to the significance of the phenomena; but the following statements will convey a summary of the present position of the inquiry regarding *glycogenesis*, as set forth in the *Medico-Chirurgical Review* for January, 1857.

From the experiments just referred to, the fact was considered as an established one, that the food, and more especially its amylaceous and saccharine elements, had the power of forming sugar, which then passed into the blood and urine from the alimentary canal. The experiments of Bernard and others, however, have demonstrated that the animal organism has the power of forming sugar altogether irrespective of the nature of the food; and that sugar exists in a certain part of the circulation —namely, from the hepatic veins to the pulmonary capillaries—

both in carnivorous and herbivorous animals. The liver is found to be this sugar-producing organ; and it is the only organ of the body which, in the normal state, is found to be impregnated with sugar—a fact established by Bernard, by observations on a large number of animals in almost every department of the zoological series. In man he examined especially the liver of five executed criminals, also that of a man who was killed by a gun-shot wound, and that of a diabetic patient who died suddenly from pulmonary apoplexy. In four of these he determined the absolute and the relative amount of sugar in the liver. The total weight of the three healthy livers was 4·205 grammes, which yielded of sugar a total of 66·074 grammes; so that the average weight of each liver being 1,401·2 grammes, the weight of sugar yielded was 22·037 grammes, to compare with the liver of the diabetic case, which weighed 2,500 grammes and yielded 57·50 grammes of sugar. He shows that the relative quantity of sugar varies little when the system is in a normal condition, very seldom exceeding 4 *per cent.* He especially demonstrated that sugar was secreted in the liver, and entered the blood from that organ; for by a comparative analysis of the blood of the portal vein as it enters, and the blood of the hepatic veins as they emerge from the liver, he found sugar in the latter, but not in the former. Sugar is not only found in the liver of adult animals, but it has been found in the livers of the human fœtus, the fœtal calf, and the unhatched chick, thus proving that it does not merely accumulate there as a product from the digestive canal.

Further, it has been determined that the sugar is undergoing perpetual destruction and renovation. It can be observed to disappear, and its further formation may be prevented under the following conditions:—(1.) By causing an animal to die slowly by starvation, or by dividing the pneumogastric nerve; (2.) When the function of the liver is disturbed by severe, and especially by acute diseases.

The following is the course described by Bernard as that taken by the sugar secreted in health by the hepatic cells:—

"It passes with the blood of the capillaries into the hepatic veins, and thence into the *vena cava ascendens.* It is at the point of discharge of the last-named vessel that the blood is the most strongly saccharine; it then becomes mixed with the blood from the lower parts of the body,

and passes up to the right auricle, where the sugar undergoes a new dilution from its admixture with the blood of the *vena cava descendens.* From the right auricle it passes into the right ventricle, and thence to the lung. In the whole of the route from the liver to the lung the blood is constantly saccharine, but the amount of sugar varies extremely, and is least at the greatest distance from the liver. In the lung the sugar, being brought into contact with the air, and mixing with the whole mass of the blood, sometimes completely disappears.

"These two organs, then—the liver and the lung—stand in an inverse relation to one another, in so far as the saccharine matter is concerned. In a fasting animal, for example, the blood which arrives at the liver contains no trace of sugar, while that which leaves it is distinctly saccharine. Inversely, the blood which arrives at the lung contains sugar, while that which leaves it contains no traces of this constituent. The sugar in this physiological state remains hidden between the liver and the lung, and this is the reason why its existence and formation within the animal body were not earlier discovered. The analysis of blood drawn from superficial veins would fail to detect it under these conditions" (*Med.-Chir. Review*, p. 32, January, 1857).

But under some conditions even in health, and therefore called "physiological conditions," sugar may be found in the blood beyond the lungs. The activity of the glycogenic function being increased with an augmented flow of blood to the liver, such as that which takes place after a meal, it is found that *four* or *five* hours after the commencement of intestinal digestion the production of sugar in the liver attains its maximum. For three or four hours at this time the production of sugar exceeds its destruction, so that "at this period of digestion we find sugar in all the vessels of the body, both arteries and veins; and we find it in the renal arteries, but in too small quantity to pass into the urine. This active and increased flow of blood through the liver thus displaces the sugar previously found there, and projects it into the circulation, and at the same time acts as a stimulus to the liver, which is still further excited by the nervous system under the influence of digestion. This increase of sugar is thus altogether independent of the nature of the food."

The cases of so-called "intermittent diabetes" are partly explicable by this interesting observation, in which the urine of digestion is saccharine, while no sugar can be detected at other periods, as in old persons observed by Bence Jones (*Med.-Chir. Trans.*, vol. xxxvi., p. 401).

The influence of diet is thus far remarkable, that the formation of sugar diminishes when fatty kinds of food are used—a fact supposed to be explained by the circumstance that the fats are absorbed directly by the lacteals, and thus do not affect the portal blood. It is also observed that in health the ingestion of amylaceous or saccharine matter does not augment the quantity of sugar in the liver, nor in the animal economy generally, although in cases of diabetes the use of these saccharine substances commonly causes a great and immediate augmentation of the sugar in the urine.

It does not yet appear clear how the sugar is destroyed in the blood in health. The destruction has been ascribed—(1.) To the oxidation or combustion of sugar in the lungs; (2.) To its combustion effected through the agency of an alkali; (3.) To the influence of extreme division in the blood, through which it may be converted into lactic acid by a simple molecular change.

Connected with the formation of sugar in the liver, Bernard shows that two substances are concerned,—(1.) One soluble in water; (2.) A substance slightly soluble in water, and which remains fixed in the hepatic tissue after all blood and sugar have been removed by prolonged washing. While, therefore, Bernard's observations showed that the blood which left the liver by the hepatic vein contains a peculiar substance of a saccharine nature, which does not exist in the blood brought to the organ in a state of health by the portal vein, the more recent researches of Dr. Pavy, of Guy's Hospital, have shown that the liver does not actually form sugar, but a substance that becomes sugar almost immediately on coming in contact with albuminous matters. "It is especially destined as a *pabulum* or fuel for the combustion process, being usually eliminated from the blood in the form of carbonic acid and water during its passage through the lungs, so as not to pass into the systemic circulation unless either its quantity be unusually great or its elimination interfered with by imperfect respiration. It appears to be elaborated by the converting power of the liver, either from materials supplied by the food or from the products of the waste of the system (Carpenter, p. 308; *Animal Physiology*, Bohn's edition).

Connecting all these observations together—namely, Parkes, Lehmann, Bernard, Pavy, Basham—may it not be suggested, as a topic of investigation, whether or not the elaboration of this

material by the liver is not arrested in Bright's disease and increased in diabetes, in the active stage of which disease it ultimately comes to be eliminated by the kidney as sugar in the urine?

The ultimate result of Bernard's investigations shows that the increased formation of sugar by the liver, and its presence in the blood, is the result of some exciting cause, which, acting by reflex action, conveys the stimulus to the *medulla oblongata*, whence it is propagated by the spinal cord and filaments of the great sympathetic nerve to the liver, and so excites its *glycogenic* function. This doctrine is supported by the following experiment of Bernard:—

"When we prick the mesial line of the floor of the fourth ventricle, in the exact centre of the space between the origins of the auditory and pneumogastric nerves, we at the same time produce an exaggeration of the hepatic (saccharine) and of the renal secretions; if the puncture be effected a little higher, we very often only produce an augmentation in the quantity of the urine, which then frequently becomes charged with albuminous matters; while, if the puncture be below the indicated point, the discharge of sugar alone is observed, and the urine remains turbid and scanty. Hence it appears that we may distinguish two points of which the inferior corresponds to the secretion of the liver, and the superior to that of the kidneys. As, however, these two points are very near to one another, it often happens that, if the instrument enters obliquely, they are simultaneously wounded, and the animal's urine not only becomes superabundant, but at the same time saccharine" (*Med.-Chir. Review*, l. c., p. 42).

He found also that in cutting the pneumogastric nerves the secretion of sugar was stopped, but that it still took place when the floor of the fourth ventricle was irritated, after the division of the pneumogastric. Any irritation conveyed through this nerve may thus induce the diabetic state. The following are the general circumstances under which the phenomena of *melituria* become developed:—Any agents or conditions which cause a suspension of the functions of animal life, while the purely nutritive or organic functions remain intact, may bring about *melituria*. Thus the Indian *worari* poison acts; so does apoplexy produced by a blow on the skull. Local irritation of the liver itself, as Dr. Harley has shown, may also induce the condition. By the injection of alcohol and ether into the *vena portæ*, Harley was able to induce diabetes. The internal use of arsenic and quinine

has also been said to have induced saccharine urine; and thus it is not improbable that irritant substances absorbed from the bowels by the mesenteric veins may sometimes bring about the morbid state.

Symptoms.—The early symptoms of *diabetes mellitus* are obscure. Dr. Prout believed that there is a stage which precedes the formation of sugar, and which is marked by a superabundant and highly dense urine, loaded with an excess of urea. But much uncertainty prevails on this point, and nothing is assured except that the constitution is not greatly affected till the saccharine matter forms, and is eliminated by urine. In some very few instances the quantity of urine passed is hardly greater than in health, but more commonly it is in great excess, amounting to eight, ten, sixteen, thirty, and even more pints during the twenty-four hours, so that the patient is incessantly disturbed in the night, and loses his sleep, while the urethra and its orifice become inflamed and sore.

At this period the general health begins to give way; thirst is intense, and the patient often drinks many quarts, or even gallons, in the course of the day. The quantity of water drunk has been believed to be less than the quantity of urine passed,—in some instances only as one to four; but this statement, however, is not now believed to be correct. From the careful experiments of Dr. Parkes and others to determine this point, it appears that the quantity of urine is actually *less* than the quantity of water taken in liquid and solid food; and this is more especially seen to be the case if long periods (ten or twelve days) are taken for examination. Water is often retained for some time in the body of diabetics; and if an observation be made in a single day, it may happen that some of the urine retained from the previous day is then poured out. It is such retention of water which may account for the apparent excess of urine over drink (Parkes *On the Urine*, p. 339). The appetite is capricious, the skin harsh and dry, and the patient becomes greatly emaciated, and loses sexual desire and sexual power. Almost all the water drunk passes off by the kidneys, and the insensible perspiration is diminished both by skin and lungs. The intestinal excretion of water is also greatly lessened; hence the bowels are costive and the fæces dry and hard. The water is not passed off by the kidneys so soon as in health. If a diabetic person drink water in the morning, the urine may not be

increased till mid-day; but if grape-sugar be added to breakfast, the urine is passed as rapidly as in health. In advanced cases the drain upon the constitution is so great that the alveolar processes are absorbed, and the teeth, loosened in their sockets, are apt to fall out. These symptoms are much relieved by medicine, and life much prolonged; but often, when the case appears most favourable, tuberculosis becomes apparent, and the patient sinks under this disease.

When *diuresis* is considerable, the urine should invariably be examined, and its constituents determined. A faint sweetish odour may be perceptible in diabetic urine, comparable to fresh hay or milk. The chamber-vessel should be examined for crystals of sugar which may have been formed (fig. 2). The best evidence, however, is that derived from chemical tests.

A portion of urine, which is usually of a light-straw colour, should be taken, and its specific gravity determined; and if greater than 1·020, it should be evaporated, and if sugar be present, we shall have a dark-brown residue, something like treacle. This extract, like the natural sugars, consists of crystallizable matter and of an uncrystallizable syrup; and to separate them Dr. Christison recommends that the extract be agitated with rectified spirit, and the residue boiled in another portion of the same fluid, when, on cooling, the crystallizable sugar will separate in light-greyish grains like grape-sugar. Again, if sugar should be suspected to exist, even in minute quantity, a small portion of yeast should be added to a small quantity of the urine, when, if sugar be present, fermentation will ensue, and each square inch of carbonic acid given off corresponds nearly to one grain of sugar. This test is so delicate that one part of diabetic urine, according to Dr. Christison, may be detected in 1,000 parts of urine of the density of 1·030. The most certain and approved test is that known as

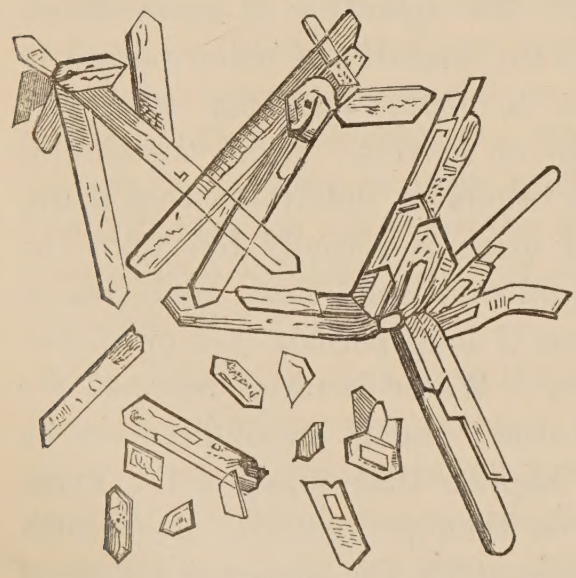


Fig. 2.*

* Crystals of diabetic sugar from diabetic urine (after BEALE, p. 150).

"*Trommer's test*," based on the re-action of the salts of copper. A portion of urine in a test-tube is to be treated with *one* or *two* drops of a solution of *sulphate of copper*, and afterwards a considerable excess of *potash* is to be added. The dark-blue solution which results is then to be held over the spirit-lamp and boiled for a moment, when a yellowish-brown *precipitate* of the sub-oxide of copper is produced. Dr. Roberts expresses a want of certainty in the results of most of those tests. He recommends Fehling's copper solution as the best test. It consists of Sulphate of Copper, gr. viii.; Tartrate of Potash, ʒss.; Liquor Potassæ, ʒi. Some of this test solution is to be boiled, and some drops of the suspected urine added to it. If sugar be abundant, a thick yellowish opacity and deposit of yellow sub-oxide are produced, which changes to a brick-red at once if the blue colour of the test remains dominant. If no such re-action ensues, more urine is to be added, until a quantity equal to the bulk of the test employed has been poured in. The whole must be again heated to the boiling point; and if no change occurs, it is to be set aside without further boiling. As the mixture of the urine and test cools, if no milkiness is produced, the urine may be confidently pronounced free from sugar. No quantity *above a fortieth of a grain* can escape such a test, and any quantity below that does not appear to be of clinical importance. It is important to bear in mind that Fehling's test solution must always be freshly prepared. For the application of further tests, see Dr. Beale's Tables, p. 21.

The density of diabetic urine, however, is one of the best indications. This fluid varies in density from 1·30 to 1·074 (BECQUEREL); but on an average, and tolerably constantly, it is 1·040; and when the urinometer stands above 1·030, we may suspect that sugar is present. The quantity of sugar present has been calculated by Dr. Henry, in urine of density 1·020, to be 402 grains in every pint, while at 1·050 it contains 958 grains of sugar—the increment being, as he conceives, one scruple, or nearly so, for every degree of specific gravity between the extremes that have been mentioned. If these data be correct, a person passing sixteen pints of urine daily, of specific gravity 1·050, actually passes nearly two pounds avoirdupois of sugar. But the amount varies greatly, amounting sometimes to *one* pound or *two* pounds, or even two and a half pounds,

in twenty-four hours. In a few months patients will pass their own weight in sugar, (PARKES, l. c.) Its amount is mainly influenced, in the first instance, by the saccharine and amylaceous nature of the food, which always augments the amount of sugar. The augmentation is quite perceptible about two hours after food, and continues for four or six hours, if the amount of starch taken has been considerable. It is probable, though it is not absolutely proven, that all the starch eaten is converted into sugar; and in cases accurately observed by Mr. Graham and Dr. Parkes for a considerable length of time, the quantity of sugar excreted by the urine never exceeded the amount of starch; and almost all the starchy food was accounted for by the diabetic sugar (WALSHE, PARKES). It has been supposed by some that when the starch only is converted into sugar, it is the earliest stage of the diabetic state; and it is certain that during the progress of some cases sugar begins to be formed from other sources and in other ways, and is no longer derived solely from the starch.

In some cases the sugar may recognize no other origin than the starchy food for many years. Such seems to have been the case of the late Mr. Camplin, of Finsbury Square, who kept his disease at bay for ten or twelve years, (*Med.-Chir. Trans.*, vol. xxxviii., p. 69; PARKES, l. c.) Complete fasting or abstinence from saccharine and starchy food for eight or twelve hours reduces the quantity of urine to the normal amount, and brings down the specific gravity to the usual figure. Sugar can then neither be detected in the urine nor in the blood, as was determined by Dr. Parkes after numerous analyses of blood under such circumstances (*On the Urine*, p. 348).

In the majority of advanced cases of diabetes, sugar is not only produced from starch, but also from *nitrogenous* foods, especially *gluten* and *animal food*. In such cases complete abstinence for a time from food lessens, but does not entirely remove, the sugar from the urine. Perhaps in all such cases the formation of sugar from albuminous food indicates a more advanced or active stage of the disease than when the sugar is formed from starchy compounds only; and it is probable that the amount of sugar from this source increases as the disease advances. Dr. Parkes refers to a case related by Schultze, in which the amount of sugar in the urine when the patient was on mixed diet was *one-third* more

than could have been furnished by the starch food alone; and the amount can always be ascertained by keeping the patient strictly on a meat diet, and feeding him with starch from time to time as an experiment (l. c., p. 348).

Thus three conditions affecting food would seem to be present in cases of diabetes:—

The earliest and fundamental one continues to act throughout, and is distinguished by complete arrest to the normal metamorphic changes of starch and sugar—an arrest probably associated with some substance in the digestive canal which absorbs the sugar. At first it affects the sugar derived from starch food, then it affects the sugar derived from nitrogenous food. Dr. Bence Jones suggests that in some cases the changes may pass one step beyond the conversion of starch into sugar, and produce "vegetable acid." He believes a disease exists which is thus allied to diabetes, and characterized by a great amount of acid, probably *lactic*, in the system and in the urine. The chief transitional changes of starch enumerated by Dr. Bence Jones are as follow:—Starch into sugar, into vegetable acid, into carbonic acid; and he supposes the arrest to occur at the acid stage, instead of at the sugar stage, in the morbid condition he describes.

The second condition is an abnormal production (probably in the liver) of sugar from nitrogenous food—*i. e.*, an amount of production which is abnormal—combined with arrest in the transformation of sugar normally formed (PARKES). A diabetic patient, kept on the most rigorous meat diet, has been known to pass a quantity of sugar corresponding to *two-fifths* of the entire meat food, or *three-fifths* of the *albuminate* contained in the meat (GRIESINGER, quoted by PARKES).

A third condition may be also distinguished—namely, one in which the *tissues* themselves, and especially the muscles of the body, contribute to the morbid formation of sugar. This occurs under circumstances of extreme inanition, when almost no food is being supplied to the body, and yet a constant quantity of sugar is eliminated. Traube, Parkes, and Ringer have each recorded such cases. In one of Dr. Parkes's cases the blood, after seventeen hours' fasting, was found to be still very rich in sugar (PARKES, l. c., p. 350). It is, however, a question whether this is an abnormal formation of sugar merely, or a further and more advanced stage of the disease. There are also cases which may

be noticed here, in which the patients continue to lose ground although the quantity of sugar lessens, and in which the substance known as *inosite* or *muscle*-sugar is found in the urine (fig. 3). It increases in quantity as the sugar lessens, and at last as much as eighteen and twenty grammes of pure *inosite* have been procured from the day's urine. The *inosite* may be obtained in the form of colourless prismatic crystals, which are efflorescent. It does not reduce the oxide of copper to the state of sub-oxide, as is the case with *diabetic sugar* and *grape-sugar;* and it is said to have not quite the same composition as the latter substance, but is represented by $C_2 H_2 O_2$; so that one atom of *grape-sugar* would thus represent six atoms of *inosite.* It may be detected by evaporation of the suspected fluid nearly to dryness in a platinum basin, when, if a little ammonia and chloride of calcium be added, a rose colour is produced, especially if the mixture be again concentrated by evaporation. M. Hohl records a case of diabetes in which, while the proportion of sugar gradually diminished, the *inosite* gradually increased in amount till upwards of 300 grains were passed in the twenty-four hours (PARKES, BEALE). The observation is one of great interest in connection with the pathology of this remarkable constitutional disease.

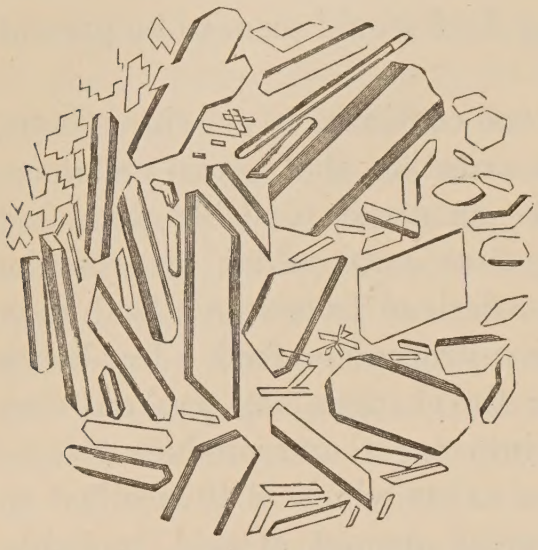


Fig. 3.*

Professor Sidney Ringer, of University College, has made some observations of great interest, to show the amount of *urea* and of *sugar* respectively furnished by the tissues of the body and by nitrogenous food. (1.) During inanition one series of observations showed an enormous disintegration of tissues (48 grammes of urea and 105 grammes of sugar being passed in twenty-four hours), the relation between the urea and the sugar being tolerably constant. In the second series, when nitrogenous food was taken, the urea increased about the third hour after food, and reached its maximum about the fifth hour, after which it continued to diminish,

* *Inosite* or *muscle-sugar*, crystallized partly from alcohol and partly from water (after FUNKE).

and reached the inanition amount in the eighth hour. The sugar followed the same rule, and almost in an exact ratio; but the urea was in slight relative excess to the sugar, showing that the nitrogenous food raised the urea slightly more than it did the sugar. During inanition the urea was to sugar as 1 to 2·235, while after nitrogenous food the urea was to sugar as 1 to 1·9. It thus appears certain, as Dr. Parkes observes, that there is some close connection between the amounts of urea and of sugar in such cases as diabetes. The amount of urea may be double or even treble the normal amount, and that to an extent much greater than can be accounted for by the food taken, and due probably to some peculiarity in diabetes, causing heightened metamorphosis of tissues, such as might arise from the excessive action of oxygen on them (PARKES, l. c., p. 342). The amount of sugar is still further increased if diabetic patients take more water than their thirst demands; and it is probable that the urea is also increased, although exact experiments are wanting.

On standing, diabetic urine soon begins to ferment, with the appearance of *lactic, butyric, acetic,* or *formic acids,* and develops the yeast plant; and during this fermentation the urea entirely decomposes. Dr. Christison gives the following formula for ascertaining the amount of solid matter in *diabetic urine*:—"Multiply the excess of the specific gravity over 1·000 by 2·33, the result is the number of parts of solid matter in 1·000 of urine."

Prognosis.—The ultimate issue of every case of diabetes is probably fatal; at least, the number of cases in which the urine is rendered permanently natural is extremely small, and many of them, at the moment the disease seems to have yielded, die of phthisis. Even when the presence of the saccharine principle has been so far conquered that it alternates with lithic acid deposit, or that lithic acid becomes the prominent feature, the circumstance is anything but favourable, for such individuals generally die of some sudden and overwhelming attack of internal inflammation or of apoplexy (PROUT). On the other hand, where the source and nature of the mal-assimilation can be discovered, and either rectified or held in check, and if the patient will submit to regimen, a favourable result may be hoped for in some cases.

Treatment.—There are few diseases in which the treatment has been more varied than in *diabetes mellitus.* Every conceivable medicine has been given, but exact quantitive determinations

of the effect of them on the sugar have rarely been made. The emaciated state of the patient presents an insurmountable obstacle to bleeding. Nevertheless, this mode of treatment has often been practised, and as much as 160 to 170 ounces of blood have been taken in a few weeks. The late Sir Henry Marsh found blood-letting of service when the disease was recent, and the strength of the patient still maintained. He found that it promoted the action of diaphoretic remedies; and especially when followed by the tepid bath. He found leeches to the epigastric region of benefit, when internal heat with fulness and tenderness prevailed there, with a "gnawing" feeling about the stomach. In the face, however, of so high an authority, the pathology of diabetes, as given in the text, does not sanction general blood-letting as a mode of cure.

Mercury, alike with *lead*, *antimony*, *zinc*, *silver*, and *copper*, are indifferent as to their influence on the formation of sugar (PARKES). Opium has been given to the extent of 100 grains in the twenty-four hours; but with an equal want of success, although it does seem to lessen the sugar, probably by lessening the appetite and hindering the taking of food (PARKES). The whole *materia medica* has been exhausted in search of a remedy for this disease. The metals, the fixed and the volatile alkalies, the vegetable and mineral acids; the astringents, purgatives, tonics, diaphoretics, and diuretics, have in their turns been administered, and each has perhaps afforded some relief; but the disease has proceeded, and finally, it may be said, nearly every patient dies whose treatment is left entirely to drugs. Dr. Prout, who considered it merely as a form of dyspepsia, conceived that each case requires a different treatment. In the early stages of the disease the Drs. Bullar, of Southampton, have found great benefit from the *tincture* of the *muriate* of iron, now called the *tincture of the perchloride of iron*. Dr. Camplin speaks of the *citrate of ammonia* in the effervescent form, generally combined with the *citrate* of iron, as more useful than any other medicine; while bitters and alkaline remedies did him great service at one period of his attack.

Opium combined with ipecacuanha is eminently useful as a sedative, especially in the form of Dover's powder; while exercise, warm clothing, friction of the surface, hot bathing, and diaphoretics, improve the cutaneous functions. The functions of the skin must always be inquired into, and must be kept active. The

nitro-muriatic baths, and the internal administration of the acid, might also be employed with some prospect of benefit in cases requiring acid tonics. This is more generally the case in the young, and in the early stages of the disease, in which the *tincture of the perchloride of iron* is also of service, prescribed in the *infusion of quassia* or of *calumba*. But each case requires to be made a special study, considering that many, or at least several, organs may be concerned in the disordered working of the system (PROUT, CAMPLIN). The *mistura ferri composita* is another of the iron preparations which has been found of service. The administration of alkalies, as recommended by Miahle and Contour, is also occasionally successful.

The little benefit derived from medicine induced Dr. Rollo to try the effects of an entirely azoted or animal diet; and out of nineteen cases, two are said to have been cured by this means. A full and generous diet is unquestionably useful in these cases; but the patient soon gets disgusted with mutton or beef, or both, for breakfast, dinner, and supper: he consequently nauseates a meat diet, and abandons it altogether. A diet of salt fish has been attempted; but the patient in a short time so loathes it that it has to be given up. A mixed diet, therefore, if contra-indicated by some theories, is at least the best to adopt in practice, and is consistent with the remarks made under pathology, if duly regulated and aided by other means. It will be evident, however, that those vegetables which contain a large quantity of saccharine matter should be avoided in some degree, as potatoes, grapes, or other very ripe fruit, and, *à fortiori*, sugar itself.

"There are, therefore," as Dr. Camplin justly observed, "certain fixed broad principles upon which the disease is to be treated." In all cases the various influences of the stomach, liver, skin, and kidneys on the nervous system and on each other ought to be sought out and determined, and the basis of treatment arranged accordingly. *It is necessary to abstain from all amylaceous food, as well as from every solid and liquid containing sugar, or any substance readily convertible into sugar.* Fat meat and eggs may be taken, if biliary derangement is not induced by them, and fish is a most important article with which to vary the monotony of the dietary. Milk also may be indulged in occasionally, as it is not found that the sugar it contains is readily converted into glucose. Its influence, however, requires watching.

It is desirable to vary the food as much as possible during the day, taking the lighter kinds in the later meals. When soups are taken, they ought to be really good, and flavoured with aromatics or onions, to the exclusion of carrots, turnips, and pease. They may be thickened with some bran *finely powdered.* Lettuces Dr. Camplin found to agree well, when eaten sparingly with oil and vinegar, or with a little salt only, if the vinegar is likely to disagree. Pickles in small quantities may be permitted to convalescents. If cocoa agree, it may be taken, prepared *from the nibs* only. With regard to drinks: if milk is found to agree, it may be used as a drink, combined with half its bulk of lime-water, or in the form of what is known as "buttermilk" in Scotland and in Ireland, but which in England is generally given to pigs, not yet being sufficiently appreciated by natives of the country south of the Tweed. Dr. Camplin eventually found it necessary to abstain from all alcoholic drinks; but, where they are found desirable or necessary, a selection may be made from those wines and spirits which are freest from sugars. Of these, clarets may be chemically considered the best, then Burgundy. The co-called "fruity wines" must be entirely interdicted; and of all alcoholic beverages *weak* brandy and water is the safest. The amount of brandy must be always *measured* and taken as directed by the medical attendant. A *tea-spoonful* in a tumblerful of water is generally sufficient for an ordinary dinner drink; and Dr. Camplin candidly and feelingly observes, from his own experience, that no diabetic need expect to recover or continue well who cannot exercise self-control, and make up his mind to be temperate *in all things.*

Seeing that under this system of diet the patient is deprived of the use of ordinary bread, Dr. Camplin devised a form of bread prepared solely from *bran;* and the great value of *bran cakes* as a substitute for bread in cases of *diabetes* has now been established by the experience of so many individuals that its use ought to be insisted on. The bran used should be *thoroughly washed,* so that it may be as free from starch as possible; and *finely powdered,* so that it may not irritate the susceptible mucous membrane of the intestines. Such carefully-prepared and finely-powdered bran may be obtained from Mr. Batchley, of 362 Oxford Street, London, near the Pantheon; also of Mr. Donges, Gower Street, London, North. But if it is desirable to prepare the powder at home as it

is required, a special mill and sieve for this purpose are necessary, and may be obtained of Messrs. Evans Brothers, 54 Bricklane, Spitalfields, London, E. (Dr. Camplin's *Monograph on Diabetes*).

The *formula* for bran cakes is thus given by him:—"Take a quantity of wheat bran (say a quart). Boil it in two successive waters for a quarter of an hour, each time straining it through a sieve; wash it well with cold water on the sieve, until the water runs off perfectly clear. Squeeze the washed bran in a cloth, as dry as possible, then spread it thinly on a dish, and place it in a slow oven. When it is perfectly dry and crisp it is fit for grinding into fine powder.

"The bran thus prepared is ground in the mill for the purpose, and must be sifted through a wire sieve of such fineness as to require the use of a brush to pass it through, and what remains on the sieve must be re-ground till it is sufficiently soft and fine.

"To prepare a cake, take of this bran powder three or four ounces, three new-laid eggs, one and a half or two ounces of butter, and about half a pint of milk. Mix the eggs with a little of the milk, and warm the butter with the remainder of the milk; stir the whole well together, adding a little nutmeg and ginger, or any other spice that may be agreeable. Bake in small tins (pattipans, which must be well buttered), in a rather quick oven, for about half an hour. The cakes when baked should be a little thicker than a captain's biscuit.

"These cakes may be eaten with meat or cheese for breakfast, dinner, and supper, and require a free allowance of butter; and the cakes are more pleasant if placed in the oven a few minutes before being placed on the table.

"When economy is an object, when a change is required, or if the stomach cannot bear butter, the cakes may be prepared as follows:—Take of the prepared bran four ounces, three eggs, about twelve ounces of milk, with a little spice and salt, to be mixed and put into a basin (previously well buttered). Bake it for about an hour; the loaf may then be cut into convenient slices and toasted when wanted; or, after slicing, it may be re-baked, and kept in the form of rusks.

"Nothing has yet been discovered of equal utility to these bran cakes, combining, as they do, moderate cost with freedom from starch, and sufficient pleasantness as an article of food" (Camplin *On Diabetes*, third edition).

Consistently with the experiments of Bernard, "cod-liver oil holds out some prospect of a natural plan of treatment by its use."

Dr. Pavy recommends ground almond powder, made into biscuits, rusks, and bread, with eggs, as a substitute for ordinary

bread. Mr. Hill, 60 Bishopsgate Street, London, makes such biscuit.

An abstinence from water lessens the formation of sugar; but it probably accumulates in the body, so that when fluid is again given, an excessive elimination of sugar occurs (RINGER, GRIESINGER); and patients become extremely depressed and ill if water is withheld from them, probably from the impregnation of the body with sugar (PARKES). Coffee lessens the sugar, but increases the urea. Rennets, as recommended by Dr. Gray, of Glasgow, at first lessen the sugar and water; but they afterwards increase again. Warm baths lessen the amount slightly; so does bicarbonate of soda. Hence the recommendation of Miahle and Contour.

When the diabetic symptoms subside, congestions, especially of the head, are apt to supervene. Such congestion Dr. Camplin found to subside gradually under the use of *citrate* of *ammonia* and small doses of *colchicum wine.*

The great difficulty in the treatment of diabetes is to manage the dyspepsia and impaired digestion, and, at the same time, to diminish and keep in check the formation of sugar. Warm flannel ought to be worn next the skin in all cases, and residence in a warm climate will often be of service as an aid to the means of cure employed.

(SPASMODIC) ASTHMA.

LATIN EQ., *Asthma;* FRENCH EQ., *Asthme;* GERMAN EQ., *Asthma;* ITALIAN EQ., *Asma.*

Definition.—*A constitutional disease which culminates in paroxysmal attacks of difficult breathing, which are of longer or shorter duration. The dyspnœa seems to be immediately dependent on more or less extensive contraction of the smaller bronchi, and due to tonic spasm of their circular fibres. The breathing is accompanied by a wheezing sound, a sense of constriction in the thorax, great anxietas, and a difficult cough. The attack usually terminates by the expectoration of a quantity of mucus from the lungs, which varies considerably in appearance and in amount. In some instances the mucus is thick and heavy, in others it is light and frothy, whilst in the severer forms of the disease there may be only a few dark pellets coughed up before relief is obtained* (PRIDHAM). *In the hours immediately*

succeeding the fit a remarkable diminution of the urea and chloride of sodium may occur, which would imply a considerable arrest either of formation or elimination, probably the former (RINGER, PARKES); *or to the starvation that is generally enforced at that time* (SALTER).

Pathology.—Few diseases have been the subject of greater doubts and differences of opinion as to its nature than asthma. Not unfrequently it has been confounded with dyspnœa; and the terms *dyspnœa, asthma,* and *orthopnœa* were formerly employed to designate different degrees of difficulty of breathing. Their signification must now be much more precisely defined. *Dyspnœa* is a term which is now used to denote difficulty of breathing generally, and may be due to various causes. The significance of *asthma* is defined above, and its pathology is about to be considered; while the term *orthopnœa* signifies that great difficulty of breathing in which the patient is incapable of respiring except in the erect posture.

When asthma has once expressed itself, it seldom fails of recurring, though the intervals between the paroxysms are of very uncertain duration. In severe cases the fits will return periodically every ten days or a fortnight; and in still more severe cases they will recur every night or early morning, at exactly the same hour.

It has been observed to recur in females just after the menstrual discharge, or immediately before it. It is also apt to recur in the spring and autumn, and after exposure to cold and wet. The disease is not only paroxysmal, but often periodic; by days, weeks, months, or even years. Diurnal asthma is very common, especially when associated with chronic bronchitis, heart disease, and impaired digestion. Asthma occurring once a year is usually winter asthma complicated with bronchitis.

The stomach and bowels are extremely liable to disorder in asthmatic persons; colic-like pains, flatulence, loss of appetite, and an irregular state of the bowels, are not uncommon.

There appears to be no period of life at which asthma may not make its appearance—from the earliest infancy to old age. In thirty-eight cases noted by Dr. Hyde Salter, the first access of the paroxysm occurred in *seven* during the first year of life. In one of these, symptoms of asthma were noticed at *fourteen days* old; in another at *twenty-eight* days; in another at *three months;*

in another at *one year;* and in three "during the first year." Many of the best-marked and purest asthmatic cases date from early infancy—so early in some that it were difficult to say the disease was not truly congenital. It is evidently very often dependent upon hereditary transmission and conformation; and in all such cases of its early development there was a history of its inheritance (HYDE SALTER). Mr. T. L. Pridham, of Bideford, has traced its hereditary origin in nine out of ten cases, and relates a case of asthma which commenced as early as seven years of age. Out of *thirty-five* cases in which Dr. Salter has noted this circumstance, he found distinct traces of inheritance in *fourteen.* The melancholic temperaments, the sanguineo-melancholic, the nervous, and the irritable, are most liable to the affection; and the male sex is much more disposed to it than the female (WOOD). According to the experience of Mr. Pridham, about 80 *per cent.* of the cases are men.

It is believed by not a few to be connected with the gouty or rheumatic diathesis. The disposition of the attacks to recur at distant but gradually diminishing intervals; the division of each attack into nightly paroxysms, with marked remissions during the day; the duration of the earliest fits for several days or a week, are all circumstances which point to the constitutional nature of the affection. Many of the cases recorded by Mr. Pridham inherited gout; and in some instances both diseases could be traced in the family; and in more than one instance where gout and asthma had prevailed in previous generations there were alternate attacks of asthma and of gout. He found that when women were the subjects of asthma, gout prevailed in their families in a larger proportion than in men.

The best descriptions of the phenomena of asthma have been given by medical men who have themselves suffered from it—for example, Dr. Bree and Sir John Floyer, both of whom were asthmatics (GOOD). Asthmatic patients generally live to a good old age. The lungs undergo dilatation of the air-cells, which dilatation does not much interfere with their normal action when free from attack. It produces emphysema in the same way that bronchitis does, and leads to hypertrophy and dilatation of the right side of the heart. In those cases of asthma which have been described as dyspeptic, the powers of digestion are insufficient to assimilate the food taken, and such patients can

never with impunity eat and drink as other people do; and wherever the disease has occurred in any member of a family for one, two, or even three generations back, such exciting causes as imprudence in eating or drinking, an attack of bronchitis or influenza, atmospheric influences, certain odours, mental excitement, and the like, may at any time or period of life bring to light this peculiar disease; but unless in constitutions predisposed to the disease, such exciting causes have no influence upon its development. Asthmatic people, for the most part, are said to be gifted with great energy, and talents far beyond the lot of ordinary people. They are generally courageous and resolute; and those in humble life possess intellectual attainments far beyond their station; and all generally excel in whatever subject of study they are disposed to follow (PRIDHAM). The experience of Dr. Hyde Salter, however, does not bear out this statement. A knowledge of the state of the blood and of the physiology of digestion, embracing a knowledge of the amount of the urinary and other excreta, and especially of the peculiar expectoration, in relation to diet and temperature, is of great importance to be known in cases of asthma. Dr. Sidney Ringer, the Professor of Therapeutics in University College, has made one series of accurate observations relative to the urinary excreta in a case of asthma. He found in the hours immediately succeeding the fit that a remarkable diminution of the urea and chloride of sodium occurred, which implied a considerable arrest either of formation or of elimination, probably the former (PARKES, l. c., p. 319). The urine at the commencement of an attack is generally abundant and colourless, like what is known by the name of "nervous urine;" later in the attack it is often extremely dark and scanty, and is sometimes almost suppressed (HYDE SALTER).

Mr. Pridham observed in one of his cases that the urine was suspended during an attack, on the subsidence of which there occurred an enormous secretion of it, of a dark colour, and loaded with lithates.

Dr. Hyde Salter has clearly shown that the dyspnœa of the asthmatic paroxysm is due to spasmodic contraction of the bronchial tubes; that the phenomena of the paroxysm are in a great measure those of an excito-motory kind—in other words, due to reflex action.

The exciting causes of the paroxysms are mainly due to fatigue

and physical exhaustion—sudden or violent mental emotion—certain conditions of the digestive organs—gastric irritation—the irritation of a loaded rectum—irritation of an eruption on the skin and its sudden subsidence—the irritation of certain substances and articles of food, such as cheese, nuts, almonds, and raisins, sweet things generally, salted meats, condiments, preserved and highly seasoned foods, fermented liquors, especially malt liquors, and sweet wines.

The Forms of Asthma have been variously described under the following names:—*peptic* or *dyspeptic asthma, congestive asthma, hay asthma, hysteric asthma,* and *spasmodic asthma;* but seeing that all true asthma is spasmodic, the classification proposed by Dr. Hyde Salter is perhaps the best, inasmuch as it suggests the necessity for examining into the various influences which act on the nervous system in each case, and enables the physician to arrange the basis of treatment accordingly. It is as follows :—

Class I. Those cases in which the provocatives of the attack are manifest, in which the lungs seem to be mainly concerned, the source of irritation being applied to them, as some material respired which provokes the bronchial tubes to spasms by direct contact with their mucous surface (*e. g.*, Asthma from fog, smoke; fumes of various kinds, *Ipecacuanha powder*, or that of hay; from animal emanations; from certain atmospheres; and, lastly, from blood poisoning, as after beer, wine, and sweets).

Class II. Those cases which acknowledge a reflex source of their development. Of these, five varieties are easily indicated: —(1.) Those in which the asthma follows an error in diet, or supervenes on a full meal; (2.) Those in which the source of irritation is transmitted from a loaded rectum or from uterine irritation; (3.) Those in which it arises from the sudden application of cold; (4.) Emotional asthma; (5.) Periodic asthma.

Class III. Asthma complicating bronchitis, heart disease, or pulmonary emphysema.

On inspecting the chest of a patient labouring under a severe paroxysm of asthma, the whole upper part seems almost motionless, while the inferior portions are acting within a very confined range. All the muscles passing from the head to the shoulders, clavicles, and ribs are rigid. The abdominal muscles, however, act most powerfully to increase the capacity of the chest, and its walls are kept fixed in a condition of extreme inspiration. The

chest is enlarged in every way, the diaphragm descends, the abdomen seems fuller, and its girth is increased. The stethoscope teaches us that the whole of the lungs, but particularly the posterior lungs, are labouring with a loud and deep sibilous, sonorous wheeze, accompanied with a mucous rattle, sometimes loudest on inspiration and sometimes on expiration. No respiratory murmur exists. Dry tube sounds alone are heard—rhonchus and sibilus of every variety, note, and pitch. There is complete stagnation of air in the chest. The sounds are so small that they seem to indicate spasmodic constriction of the smaller tubes; and the universal diffusion of the sound shows that the constrictions are universal over the smaller tubes. These spasms may also be observed to be constantly changing their place, disappearing in one place and making their appearance in another, so that the sounds are continually changing their character and their site. Percussion shows that the lungs are distended with air; and should an air-cell have burst, a rubbing sound will be heard, denoting the effusion of air into the cellular substance of the lung. As the fit subsides, the respiration becomes puerile, and by degrees the breathing returns to its usual state. In fatal cases the respiration becomes tracheal, slight hæmorrhage perhaps takes place, and after a severe struggle the patient dies; but this is an event so extremely rare that, from Dr. Hyde Salter's very extensive experience of this disease, he believes death never takes place immediately from uncomplicated asthma.

The duration of the fit varies. In some cases it lasts a few minutes, in others two or three hours, in others the whole night, in others three or four days, and in others as many weeks.

When the expressions of the disease are fully marked, the appearance of an asthmatic person is very characteristic. The countenance often bears the signs of distress. The shoulders are more or less elevated. The stomach is apt to be greatly distended after eating; the tongue becomes coated, and there is a tendency to fissures in it; the eyes red and prominent. Emaciation generally progresses, and there is inability to rest horizontally in bed, or to walk up a hill. The secretions from the bowels are more or less abnormal, and the urine passed generally shows a variable deposit. In extremely severe cases, when remedial measures are not taken to subdue the constitutional affection, the nights may be passed by the patient in a state of great distress.

Unable to lie down in bed, his paroxysms may sometimes be so severe that he almost anticipates death before morning—were it not that he becomes accustomed to the severe nature of the symptoms—till a copious heavy expectoration is with difficulty thrown off from the lungs; and as the day advances he becomes somewhat relieved, although it may be passed still in great discomfort. Asthmatic patients are generally large feeders, although the desire for food may not be remarkable, believing that it is necessary to eat and drink well, in order to sustain the strength to encounter the paroxysms of the disease. In some the difficulty of breathing is constant, and always worst after a meal; and, as a rule, they can never, without aggravation of the disease, eat and drink as other people.

The pulse increases in frequency towards night, and subsides in the morning.

Many premonitory phenomena indicate the approach of a paroxysm, but the precursory symptoms are liable to great variation in different persons, according to the proximate cause of the paroxysm. Some patients suffer from fearful headaches, the approach of which they dread; and the heart labours with so much palpitation, and such irregularity of action, that rupture of a blood-vessel seems imminent. Eruptions on the skin sometimes lessen, and even disappear. There may be also some warning during the night of the immediate approach of an attack, in the shape of huskiness of the throat; and during the middle of the night, or towards early morning, the patient is awakened by an oppression which renders it impossible for him to lie down again. In a short time the paroxysm gains strength, and the patient breathes as it were by jerks, each aspiration being accompanied by a spasmodic effort, which seems as though it would burst open the chest. The contractions of the muscles in the neck and below the ribs in front of the chest are very great, and often, at the same time, most painful. The attacks are not of equal violence at all times.

The majority of asthmatics know that an attack is coming on, by certain feelings in themselves, or by certain conditions of the system, of which they are aware. The precursory symptoms generally show themselves on the night previous to the attack, or sometimes for two nights before it, or even for a longer time. Extreme drowsiness and sleepiness are common precursory phenomena which indicate the approach of a paroxysm—the com-

mencement of the nervous condition of which the succeeding respiratory phenomena are the more complete development; and such precursory phenomena must be looked upon as an integral part of the paroxysm (HYDE SALTER).

Extreme wakefulness, unusual mental activity, and buoyancy of spirits, constitute another set of premonitory phenomena seen in some other asthmatics; and Dr Salter mentions a case in which ophthalmia always ushered in the paroxysm of asthma. At other times, and with other patients, the premonitory symptoms are connected with the stomach, and consist especially of loss of appetite, flatulence, costiveness, and certain peculiar uneasy sensations in the epigastrium.

The time, according to Dr. Salter, at which a paroxysm commences, is almost invariably in the early morning, from three to six o'clock. In some the usual time is the evening, just after getting into bed, and before going to sleep. Even in such cases as night watchmen, who turn day into night and night into day, Dr. Salter relates that, though the ordinary times of sleeping and waking were transposed, the paroxysm came on at the usual time —from five to six in the morning, towards the end of the vigil, when the patient was up and awake.

Profuse *diuresis* not unfrequently attends the first stage of a paroxysm of asthma. The urine is then a pale limpid water, exactly like the urine of hysteria. This abundant watery secretion comes on soon after the paroxysm commences, and generally lasts for the first three or four hours, when it ceases altogether.

Neuralgic pain constitutes another early symptom, in the form of deep-seated, aching, constant, and wearying pains in the limbs, joints, or testicles.

The characteristic wheezing of a commencing paroxysm generally commences while the patient is yet asleep; and as the difficulty of breathing increases, he gradually or partially awakes, and sits up in bed "in a miserable half-consciousness of his condition." A temporary abatement occurs, and sleep may again overpower him, to be again awoke, and again to sit up. By and by the struggle ceases between sleep and the full expression of the paroxysm. The *dyspnœa* increases, so that he can lie back no more. He throws himself forwards, plants his elbows on his knees, and, with fixed head and elevated shoulders, labours for his breath like a dying man. A most distressing spectacle is now

presented by the asthmatic. If he moves at all, it is with the greatest difficulty, creeping by stages from one piece of furniture to another. Most commonly he sits fixed in a chair, immovable, unable to speak, or even perhaps to move his head in answer to questions. His back is rounded, his gait stooping. His chest, back, shoulders, and head are fixed; and, when he looks from object to object, he merely turns his eyes like a person with a stiff neck. His shoulders are raised almost to his ears, and his head thrown back and buried between them. The better to raise his shoulders, and to spare muscular effort, he fixes his elbows on the arms of the chair; or he plants his hands on his knees; or he leans forward on a table; or sits across a chair, and leans over the back of it; or he stands grasping the back of a chair, and throwing his weight upon it. In this latter attitude Dr. Salter has known a patient stand for two days and nights unable to move. Sometimes the patient may lean against a chest of drawers or some piece of furniture sufficiently high to rest his elbows upon in a standing position. At every breath the head is thrown back, the shoulders still more raised, and the mouth a little opened, with a gasping movement. The expression is anxious and distressed. The eyes are wide opened, strained, turgid, and suffused. The face is pallid; and if the dyspnœa is extreme and prolonged, it becomes slightly cyanotic. The labour of breathing is so great that beads of perspiration stand on the forehead, or even run down in drops upon the face, which the attendant must constantly wipe off, for the patient is so engrossed with his sufferings and the labour of breathing that he is almost unconscious of what is going on around him; or he is impatient and intolerant of the assiduities of those who are in vain trying to give him some relief.

If the bronchial spasm is protracted and intense, the temperature falls: the oxygenation of the blood is so imperfectly performed, from the sparing supply of air, that it is inadequate to the maintenance of the normal temperature. The extremities especially get cold, blue, and shrunken; but while the temperature is thus depressed the perspiration may be profuse. This union of coldness and sweat, combined with the duskiness and pallor of the skin, gives to the asthmatic so much the appearance of a dying man that sometimes even the initiated may fear that death is impending.

The pulse during the paroxysm is always small; and small and feeble in proportion to the intensity of the dyspnœa—due to pulmonary capillary arrest; and immediately the paroxysm yields, the pulse begins to resume its normal volume.

Itching under the chin is a common symptom of an approaching paroxysm of asthma. This itching is incessant, of an indefinite creeping character, and scratching does not relieve it. It often extends over the sternum and between the shoulders. It appears the moment the first tightness of breathing is felt, and subsides when the paroxysm has become confirmed.

The most exhaustive monograph on this disease is that by Dr. Hyde Salter, F.R.S., Physician to the Charing Cross Hospital; and the reader desirous of more full details will do well to consult his work on *Asthma; its Pathology and Treatment.*

Diagnosis.—The preceding account of the pathology and symptoms of asthma renders it obvious that it may not easily be confounded with any disease of the chest or larynx, if auscultation and percussion are carefully attended to, and with a due regard to the history of the case. The sudden attacks of the paroxysms, the short periods of their duration, the violence of the symptoms at the time, their returning after intervals of comparative ease and of tolerable health, are sufficient to characterize the disease.

It is only when asthma complicates other diseases that its diagnosis may be obscure and its treatment uncertain.

The diseases with which it has been confounded are,—(1.) Spasmodic affections of the larynx; (2.) Severe cases of sudden and *acute bronchitis;* (3.) *Angina pectoris;* (4.) *Hydrothorax.*

The disease is also sometimes associated with the development of lesions of the heart and great vessels, and ultimately leads to them.

The character of the *dyspnœa in asthma* is also quite peculiar. It is unlike the dyspnœa of heart disease, or of that of bronchitis, or of that of emphysema; the distinctive features of each of which are as follow (SALTER):—

Heart dyspnœa is intolerant of the slightest exertion, or of the recumbent position, and sitting up or stillness may cure for the time the most violent paroxysm: the breathing, too, of heart dyspnœa has a panting and gasping character, and not the wheezing, labouring character of asthma.

Bronchitic dyspnœa is short, crepitous, and accompanied with cough.

The *dyspnœa of asthma* is often long-drawn, dry, and without cough; it gives the most positive evidence of narrowing of the air-passages, and is of such a nature as to shut off the air-supply. The wheezing, or shrill sibilant whistle, is positive evidence of bronchial contraction, which is ever changing its place. Spasmodic stricture of the minute air-tubes thus explains, as Dr. Hyde Salter clearly demonstrates, the sudden access and departure of the dyspnœa in asthma.

The *dyspnœa of emphysema* is abiding, varies but little, and has no wheeze.

The Treatment of Asthma comprises what should be done during the fit, and what should be done during the intervals, with a view to correct the constitutional state which every now and then culminates in a paroxysm of asthma.

When the patient is labouring under a fit of either of the forms of asthma, our efforts must be directed to tranquillize his suffering and to shorten the attack; but so capricious is this disease that what will benefit the patient in one attack will be of little use in another. As a general rule, however, any exciting cause actually present and in operation must be removed: an undigested meal, or constipation, must be got rid of—relieved by an emetic in the one case, or by an enema in the other; the patient should be supported by strictly tonic regimen; and *camphor mixture*, to the extent of about an ounce and a half, combined with a drachm of the *spirit of nitrous ether* and some *morphia*, may be given every hour, or every two hours, for a short time. If the head should be affected by the opium, some milder narcotic should be substituted, as *tincture of hyoscyamus*, to the extent of about fifteen drops for each dose. In other cases, or in other attacks, *asafœtida*, *castor*, *musk*, or *hydrocyanic acid*, to the extent of ℥iij. every six hours, may be substituted. Again, if the fit should occur after a hearty meal, and after an emetic has been given to empty the stomach, the *tincture of rhubarb* or the *sulphate of magnesia* should be continued in repeated small doses. If the attack be long, arrow-root or sago, with small quantities of wine or brandy, should be given to support the patient under his laborious and exhausting sufferings. *Ipecacuanha*, *tartar emetic*, and *tobacco* are the drugs which most rapidly relax spasm as direct depressants. There is, however, great danger in the use of the latter, from unmanageable and dangerous collapse. And

tobacco ought never to be indulged in by the asthmatic, except as an agent in the cure of his disease; for then only can he look to it for relief. Ipecacuanha is the most manageable of these remedies, and ought to be given in a dose of twenty grains at the onset of the paroxysm. The tobacco should be smoked from a pipe.

The feelings of the sufferer should be consulted as to the temperature to which he should be exposed during the paroxysm. Where there is organic lesion of the heart and large vessels, the fresh air is extremely grateful and reviving, its coldness giving power to the circulating organs, and, by lowering the temperature of the body, enables the patient to live on a smaller quantity of oxygen. It is on this principle that the dog, barbarously asphyxiated by the effluvium of the Grotto del Cane, for the amusement of travellers, is thrown into the water, where he is able to breathe at the temperature of the water, when he would have died at the temperature of the atmosphere. The toad, also, when cooled down, will live for an incredible length of time encased in plaster of Paris; but if his body has a high temperature the experiment is soon fatal. On the contrary, when the paroxysm is purely a spasm of the bronchial tubes, warmth, by relaxing the spasm of the bronchial tubes at their ultimate divisions, is generally more useful than cold.

But it is the treatment during the interval which is all-important; so much so, that few cases will be found of true spasmodic asthma which are not entirely under the control of well-regulated dietetic management. "More is to be done for *asthmatic patients* on the side of the stomach than in any other direction;" and by many observing and thoughtful physicians dietetic treatment is regarded as the only certain treatment of asthma. Mr. Pridham, of Bideford, in Devonshire, has been very successful in the management of asthmatic cases, by extremely strict dietetic treatment and sedatives during the intervals of the paroxysms (*Brit. Med. Journal*, June 9 to December 29, 1860). His plan of treatment is somewhat as follows:—The secretions from the bowels are first of all to be corrected by the following pill at bedtime, followed by a saline aperient in the morning:—

℞. Pilulæ Aloes cum Myrrhâ, gr. iii.; Pilulæ Hydrargyri, gr. i.; Extracti Taraxaci, gr. ii.; Extracti Strammonii, gr. ss.; M. Fiant. pil. ii.

Or giving every alternate night, in the form of a pill,—

℞. Pil. Hyd., gr. iv.; Pulv. Ipecac., gr. i.

And on the following morning,—

Mist. Sennæ comp., ℥i.; Bicarbonatis Magnesiæ, gr. x.; Bicarbonatis Sodæ, gr. viii.; and during the day small doses of Compound Rhubarb Powder.

After having thus attended to the general secretions for about ten days, the strict dietary system is to be commenced.

The diet must be regularly weighed out, and adhered to with the greatest strictness, the hours of meals being most rigidly fixed as follows:—

Breakfast at *eight* A.M., to consist of half a pint of green tea or coffee, with a little cream, and two ounces of dry stale bread.

Dinner at *one* P.M., to consist of two ounces of fresh beef or mutton, without fat or skin, and two ounces of dry stale bread or well-boiled rice; three hours *after* dinner (not sooner) half a pint of weak brandy and water, or whisky and water, or dry sherry and water, may be taken, or toast-water *ad libitum*.

Supper at *seven* P.M., to consist of two ounces of meat as before, with two ounces of dry stale bread.

The patient is not to be allowed to drink any fluid whatever within one hour *before* his dinner or supper, and not until three hours after either of these meals. At other times he is not limited as to drinks, otherwise than that all malt liquors are to be prohibited. *Soda* or *seltzer*-water may be indulged in at other times when thirsty.

With this dietetic treatment sedatives are to be given as follows:—

Three grains of the Extract of Conium are to be taken four times a day—namely, at the hours of seven, twelve, five, and ten,—the dose to be gradually increased to five grains four times a day. To each of these pills a *fourth* of a grain of the Extract of Indian Hemp may be added, which may be gradually increased to one grain in each dose.

Under this treatment in a few days the distressing symptoms may be expected to subside; and after the regimen has been strictly persevered in for at least a month, two ounces more of meat may be permitted, if digestion is found to be sufficient. The stools must be repeatedly seen by the physician, and the stomach must not have more to do than it can accomplish. The powers of digestion are known to be recovering when the

stomach craves for food as the hour of nourishment arrives. If flesh is gained, strength improves; and while the tongue cleans, the appetite improves, the distension of the stomach lessens, and there is sufficient evidence that the powers of digestion are recovering. Great encouragement is then given for the physician and for the patient to follow up the line of treatment which is here indicated. The patient ought also to be able to sleep six or seven hours at a time, and to lie in bed all night. If these results follow, the ultimate cure of the disease may be looked for; but it may at the same time be taken for granted that the asthmatic can never with impunity eat and drink as other people. It is only by the exercise of such self-denial as is implied in the carrying out of such instructions that the patient has it in his own power to live a life of comparative ease and comfort. Many such patients who are not possessed of such resolution, self-denial, and strength of mind, will say such dieting does not suit their constitution, and that consequently they cannot or will not persevere; but no trial of the remedy can be considered sufficient which does not embrace a period of at least six months, the physician taking care to ascertain—(1.) The weight of the patient, his age and height, before commencing any treatment; (2.) The state of his excreta, and the amount of the urinary elements—especially the urea, the uric acid, and the like; (3.) During the course of the treatment, at stated times, such physiological information ought to be regularly obtained.

It is confessedly difficult to persuade many people to live so abstemiously, for many cannot control their appetite; or they believe that in so limiting themselves in regard to diet they will injure their constitution.

The abnormal ravenousness of appetite it is therefore necessary to subdue by sedatives other than opiates. Asthmatics are generally dyspeptics; and as a result of the experience of Dr. H. Salter, the most simple rule regarding the diet is:—Let no food be taken after such a time in the day as will allow digestion being completed or the stomach empty before going to bed. The time when the last solid food should be taken will depend upon what the bedtime is. If ten, or half-past, then three or four should be the dinner hour, after which no more solid food should be taken.

Dr. Salter's dietary in cases of asthma would be something as follows:—*Breakfast.*—A breakfast cup of bread and milk, an egg,

or a mutton chop, or some cold chicken or game. Tea is better than coffee, and milk and water better than either. *Dinner* (not before two or four o'clock).—Mutton ought to be the staple diet; beef or lamb rarely, pork or veal never. Succulent vegetable or potato may be eaten, and a little farinaceous pudding or stewed fruit, or fruit out of a tart, should conclude the dinner. Water is the best fluid to drink, and there should be no cheese and no dessert.

The quantity of food eaten should be small, and therefore highly nutritious, extremely digestible, and of the simplest and plainest kind.

Open air exercise must be freely taken, but not within three hours after eating animal food, and the exercise must be always short of fatigue. The greatest punctuality is necessary to be attended to as regards the taking of food as well as medicine; and the bowels should be caused to act immediately after breakfast, either naturally or by means of an enema. In truth, success greatly depends on the regularity with which all the functions of the body can be performed; and care should be taken to rest the body and mind at least for one hour after food. Smoking stramonium, the inhalation of chloroform, and the like, although they appear to soothe and mitigate the paroxysm in some cases, yet they do not appear to *shorten* the attack in any.

The fumes of *stramonium* are to be collected in an inverted glass bowl with a narrow mouth. The bowl being charged to its full, is placed under the mouth of the patient, who is directed to inhale, to the fullest extent in his power, the smoke which has been collected in the bowl. Or the stramonium may be smoked as tobacco is smoked, then puff the smoke into a tumbler, and inhale it cold into the lungs (BULLAR). Or it might be smoked as an Eastern smokes the Oriental hookah, in which the smoke is purified by being passed through water. Savory and Moore prepare cigars and cigarettes of stramonium. The fumes of brown paper saturated with a solution of nitrate of potash sometimes also relieve the spasms.

Indian hemp, in doses of from two to four grains of the extract, or thirty minims of the tincture, will often relieve the spasm for the time being, but may fail ever after, (See Watson, *Lectures on the Practice of Physic*, vol. ii.)

CANCER—Syn., MALIGNANT DISEASE.

Definition.—*A disease inherent by birth, or otherwise inbred. Its presence and complete development is indicated by the occurrence of peculiar growths in different parts of the body, to which the names of* cancers *or* malignant growths *have been applied. The malignant character of cancers is indicated by one or more of the following conditions:—Constant progress of the growths, their continuing to return after extirpation, not only in the original seat, but in the distant and internal parts of the body; destroying and causing absorption of the invaded textures; infiltrating the tissues to an indefinite extent; and tending to suppurate, and to affect the glands to which the lymphatics lead from the seat of local lesion. The increase and nutrition of these growths produce a peculiar marasmus, which tends to terminate in death. The anatomical constitution of the new growths is heterologous.—Defined more shortly as—A deposit or growth that tends to spread indefinitely into the surrounding structures and in the course of the lymphatics of the part affected, and to reproduce itself in remote parts of the body.*

Pathology.—The morbid condition of the body, the ill-health, or cachexia, which is associated with cancers cannot be referred to the blood alone. Indeed, we have no direct proofs that the blood is peculiarly affected. We cannot find in it anything distinctive or peculiar to the cancerous diathesis, either by microscopic or chemical investigation. But while none can doubt the existence of a cancerous cachexia, we have no positive knowledge concerning the state of the blood in cancerous states of the body. It is rather inferred, from various considerations, that a peculiar material is separated from the blood, and is constantly being renewed in the formation of cancers. There are no germs in the blood previous to the development of a cancer-tumor which can be recognized as a cancer-structure. It is evident, however, that a specific state of the system exists in the cachexia associated with cancer,—(1.) Because all parts of the body are liable to be infiltrated with the peculiar and specific growths which constitute the "cancers or malignant tumors," and that without any direct communication with the place where the first growth took place; (2.) Because the removal of the locally diseased part does not arrest the progress of the constitutional disease; (3.) Because the cancer-

growths tend naturally towards destruction of life, not necessarily from their local position, but through a peculiar marasmus which their existence establishes, and which some think due to the demands which these new growths make upon the system for increase and nutrition. They tend also to destruction of tissue around them, and to suppuration. A continual hectic febrile state is established, and increasing emaciation follows the intense bodily suffering and mental anxiety they induce. The countenance becomes pale and anxious, with a slight leaden hue, the features become pinched, and the lips and nostrils slightly livid. The pulse is frequent and the pains are severe. At length there is generally nausea and weakness of digestion, and a tickling cough frequently supervenes. Severe stitches strike through the local morbid parts, the pulse becomes rapid and faltering, the surface cadaverous, the breathing anxious, and death alone brings relief.

"Cancerous disease," says Mr. Paget, "or a tendency to it, is prone to pass by inheritance from parent to offspring, and to occur (probably by inheritance of common properties) in many members of the same family and generation;" but while there appears to be a tendency to the hereditary transmission both of cancerous and non-cancerous growths, there is a much greater probability of the hereditary transmission of *cancerous* than of *non-cancerous* growths, and that in the proportional probability of 22·4 for the *cancerous* and 8·2 for the *non-cancerous* (*Med. Times and Gazette*, Aug. 22, 1857).

There is abundant circumstantial evidence to show that malignant tumors are of *constitutional* origin—that they are local manifestations of a *constitutional* disease—that there is something specific, probably elaborated from the blood, which accumulates in their elements of structure. This specific material which composes cancers is different from all the natural constituents of the body; is different from all the materials formed in other processes of disease; and is associated in the malignant tumor with structural elements which must be regarded as specific and peculiar, both in form and in mode of life. The main grounds for this belief are—(1.) The evidences, not always absolutely demonstrable, of a pre-existing unhealthy state of the constitution; (2.) The prolonged duration of the constitutional state which precedes the local expression of the cancerous tumors —the long-continued elaboration, often extending through several

generations—thus showing sometimes a tendency to alternation in the inheritance of the inborn state of ill-health; (3.) The secondary pyrexia, which is the result of irritation or of elimination of a morbid material, the re-absorption of which may tend secondarily to affect the blood.

It has not been proved that the inoculation of cancerous matter is followed by even the growth of cancers, far less by the development of cancerous cachexia; and there is every reason to believe that this loathsome disease cannot be communicated by the secretions from a cancerous ulcer. Alibert has made dogs swallow the ichorous serosity collected from such a source, but the health of those animals was not impaired. Dupuytren has likewise introduced portions of cancerous parts into the stomachs of many animals—has injected the pus into their veins, and into their different serous cavities, but without producing results different from what any other irritating matter would have caused. Women, also, having the neck of the uterus destroyed by carcinoma, have conceived and born children, and yet neither the husband nor child have appeared to suffer in consequence. Alibert and others have likewise inoculated themselves with cancerous matter, and yet no contagious effect has followed. Neither has this disease at any time been known to result from accidents incident to the examination either of the living or the dead person so affected. The more recent experiments of Harley and Lawrence upon dogs have similarly failed to inoculate cancer. There are several cases known, however, in which inoculation of cancers having failed at the time, yet, nevertheless, the subjects of inoculation have died of cancer at an advanced period of life; but the value of the observation does not as yet extend beyond a mere coincidence.

Women appear to be more liable to this disease than men; and the increase is chiefly due to cancers of the breast and uterus, while in man it is chiefly the skin, the bones, and the digestive organs which suffer.

The mortality from the disease goes on steadily increasing with each successive decade until the eightieth year (WALSHE).

Age has also much influence in determining the forms of cancer and the part affected. Hard cancers are rarely observed till after forty, and from that period the liability increases with age. Its most usual seats are also those on which age and functional

activity have left their marks upon the organs. Thus it seldom occurs in the mammæ, uterus, or in the ovaries, till after the cessation of menstruation, nor in the organs of generation of the male till towards old age, nor in the different portions of the alimentary canal till after forty.

Soft cancers are most common in the earlier periods of life; but then also they are observed to involve textures whose functional activity has been ever active, such as the glandular parts—for example, the lymphatic and lachrymal glands.

The cancerous cachexia seems to be particularly influenced by physical climate, mental distress, and anxiety; and according to Dr. Walshe the maximum amount of cancerous disease is found to occur in Europe, and is rare amongst the hospitals of Hobart Town and Calcutta, and the natives of Egypt, Algiers, Senegal, Arabia, and the tropical parts of America.

We know very little, however, as to the conditions which give rise to cancers. In the words of Mr. Paget,—"The richest and the poorest alike seem to be subject to it; so do the worst and the best fed; those that are living in the best conditions of atmosphere and those that are immured in the worst; those that are cleanly and those that are foul; those of all temperaments and of all occupations; those that appear healthy and those that are diseased. We can hardly lay our hand upon any one of the various circumstances of life, in the various orders of society in this country, to which we can refer as rendering one more or less liable than another to the acquirement of the cancerous constitution."

The history of the development of cancers makes up some of the dark pages of Pathology; and in many respects the origin of such tumors is confessedly mysterious. Their first beginnings are generally hidden, being deeply buried in the tissues, so that when a swelling manifests the possible existence of a tumor, it is regarded with *doubt* in the first instance, and then by astonishment as well as dismay at the rapidity of its growth. In such doubt, astonishment, and dismay, we must recognize and acknowledge our ignorance.

The normal course of cancerous tumors we now know to be that of steady increase—a steady and certain progress towards death. No radical cure for cancer is yet known. The hand of death is most unmistakably stamped upon those who are the

subjects of cancerous growths; and we seek, in all humility, to learn something from an examination of the history of such a disease. But, to learn anything from pathological growths, they require to be studied and examined *in stages*, from time to time, in the course of their development. There *are certain stages* in pathological as in physiological growths, at which periods alone the actual mode of origin and development can be traced. A large cancerous mass does not look very promising; and we might as well expect to be able to discover, by an examination of the mature fœtus, the different steps by which its organs and parts had been formed, as hope to be able to determine in what way a tumor which at first was scarcely visible had been converted into a mass of obviously malignant growth. Thanks to Walshe, Bennett, Paget, Virchow, and many others, we are able to explain many of the phenomena of growth of such tumors, while there is much that is still dark and mysterious in their history.

It is during the time of active increase that tumors ought to be studied, having regard to their origin, development, growth, and maintenance as independent parts.

The idea that local cancers were due to entozoa, originally advanced by Adams and older writers, has never met with any proof, although it is yet entertained as probable by some; and there are many facts in the history of malignant tumors which indicate that their existence is attended with consequences very analogous to those of the existence of parasites. For—(1.) Every new formation which contributes to the body no serviceable structure must be regarded as a parasitical element in that body, alike foreign and injurious to it. (2.) The elements of malignant growths withdraw nutrition from the body, and in some instances elaborate specific secretions, to be stored up in their own structures. (3.) The malignant growth, whatever it may be, in the body or constitution, is the result of long-continued elaboration, and passes through a life of continual change before it attains its highest degree of malignant influence on the constitution. The alternate generation of the malignant growths are also exemplified in the frequent hereditary transmission of the cancerous constitution. (4.) In active growth and partially independent existence we have another remarkable analogy to parasites. Malignant tumors grow and thrive while the normal tissues far and near them are only able to maintain existence.

The local exudations which constitute the tumors or cancers consist in general of two parts, namely,—(1.) The material peculiar to cancer, consisting of very varied forms of nuclei, nucleated cells, and juice, all of peculiar natures, distributed through an intercellular medium; (2.) Areolar tissue which constitutes the stroma or skeleton part of the new growth. The first part is the essential and heterologous part of cancer. The relative quantity of these crude materials gives the most marked and obvious ground—that of consistence—on which cancers have been classified—namely, into *hard* and *soft* cancers; but the grounds of classification are by no means fixed. The nature of the substance also affords a ground of classification. When the fibrous stroma is predominant, the new growth is *hard*, and has received the name of *scirrhus*. When the cellular elements predominate, the new growths are *soft*, and have received the name of *encephaloid* or *medullary* tumors. Sometimes the supposed nature of the substance is a ground for classification,—*e. g.*, *meleceris, atheromata, steatomata.* Many of the names given to cancers are only stop-gaps, tending to retard inquiry,—*e. g.*, *colloid, alveolar*, and the like. The true nature, rather than form, ought to be the ground of classification.

These, again, are subdivided into a considerable number of varieties by the minuteness of anatomical analysis to which they have been subjected. For instance, the stroma takes various forms, like net or trellis-work, with large interspaces, or it grows papillary or villous in ramifications or vegetations. Sometimes it undergoes ossification, and then the skeleton of the cancer is formed of a network of true bony texture. This stroma part of the cancer is to be distinguished from the common binding tissue of the organ or texture into which the new growth is infiltrated. It is really and truly part of the cancer-exudations, and forms their basis. In the soft cancers it is more deficient, and then the cellular element predominates; and in them, rather than in the stroma, has the more distinctive elements of cancer-exudation been said to exist. The questions are, indeed, often asked, What are the characters of the true cancer-cell? Has the microscope discovered any structure which is decisive *per se* of cancer-growths wherever found? It may be said that it is significant of cancers that the forms of the elements of the tumors are after the pattern of those elements whose office is to separate whatever is refuse

or abnormal from the blood—*i. e.*, the glands. Cancer-cells are formed on the types of the excretory gland-cells, and although they have no special anatomical characters, it is highly probable that malignant tumors eliminate something specific—something peculiar to each of them—which may yet be discovered. Much importance has therefore been assigned, and with justice, to the character of the cell-elements, as affording a specific distinction between malignant and benign forms of growth. Viewed, however, with reference to single isolated cells, it is now agreed that they offer in themselves nothing anatomically characteristic.

The practical questions to solve when a growth is first apparent are—(1.) Is it a mere hypertrophy—a growth from a spot, of the same nature as the structure of the spot, or is it different? (2.) Will it produce a fluid, or germinate elements which will spread and contaminate neighbouring parts? In other words—Is it simple and innocent? or, Is it complex and malignant? To judge of these things it is necessary to remember that all tumors are composed of a conglomerate mass, made up of numerous little lobules. The first development takes place at a definite point or points. Round the original rudiments of the tumor (that is to be), and which are produced by the proliferation of a limited group of cells, little new *foci* are formed, which, increasing in size, group themselves round the first, and thus gradually give rise to a continuously progressing enlargement of the original *tuber*. At the peripheral portions of tumors, therefore, the most recently formed portions of the new growth are to be found; while in the centre of these tumors the elements are disintegrating. Thus the last zone of new growth may extend a considerable distance beyond any line of degeneration or alteration of structure visible to the naked eye; and hence in some tumors there may exist sources of local recurrence after extirpation. The more the anastomosis and the greater the facilities for the passage of juices, the more readily do the surrounding parts become diseased. Cartilage is slow to become cancerous by contiguity, so also are white and elastic fibrous tissues. Hence joints are often unaffected in the midst of cancerous tumors.

The more readily the morbid juices are transferred from the original seat of disease, the anastomosing elements will be found more numerous. Thus nerves are often the best conductors for the spread of cancers, not because they are nerves, but because

they are parts with soft interstitial tissue. Diffusion also takes place readily by means of vessels.

While simple tumors are *overgrowths*, in addition to being *outgrowths* or new growths, they imply a continuous reproduction of one or of several tissues taking place to an excessive extent in any limited territory, ultimately giving rise to a tumor by coalescence and growth. But to cancers or malignant tumors there is *something more specific superadded.* Their intimate structure is not like that of any fully developed natural part of the body, nor like that found in a natural process of repair or of degeneration.

Malignant tumors are indicated by the following characters :—

1. *Elements of structure and mode of growth of malignant tumors.* (1.) Continuous development of simple cells, largely supplied with very fine blood-vessels, so that the tumor is very succulent. (2.) The growth is mainly a growth of cell-elements, to the exclusion of connective or fibrous tissue. (3.) In the first instance the cell-elements resemble the cells which compose the blastodermic membrane of embryos. (4.) If a new growth is composed mainly of cells, each containing growing matter within it, in the form of another cell, or cells, or granules, it must be regarded as of malignant tendency if it is supplied with blood-vessels. (5.) *Generally* a constant or continuous repetition of the same structural element is evidence of malignancy. (6.) A tumor consisting entirely of nuclei or of minute cells abundantly supplied with fine ramifying blood-vessels is perhaps the most malignant type of all.

2. *The grouping of the elements which distinguishes cancer.* (1.) The elements are heaped together disorderly, with seldom any lobular or laminar arrangement. (2.) Multiplicity of elementary forms are sometimes seen in the mass, due to (*a.*) development, or over-growth, nodulation being an important feature in such tumors. (*b.*) Degeneration, calcareous, yellow, or fatty. (*c.*) Proliferation of cells.

3. *Infiltration by juice through parts abounding in anastomosing tissue.* Nerve-sheaths and sheaths generally are proven to give facilities for the extension of cancers—an important point for the surgeon to recognize.

4. *A peculiar tendency to ulcerate,* preceded by softening, with no disposition to heal, but a constant tendency to spread.

A peculiar softness of texture precedes ulceration, which simulates the slow fluctuation of a thick pulp, and appears to be more liquid in some places than in others. The softening is a continuous process of secretion of fluid in many respects peculiar, and is a physiological property of their structure.

5. *Malignant tumors constantly grow and progress to a fatal end,* and at the same time tend to multiply or propagate themselves.

6. *There is scarcely a tissue they will not invade.*

It is in the comparative appearance of the multitude of cells, and especially in their relative size, that most distinguishing features may be observed. While the cellular cancer-mass often shows merely small pus-like or large lymph-like cells of an oval form with many nuclei, yet when all kinds of cancer are compared, "*typical cancer cell-elements*" in quantity may be described by the following general characters:—

While the external cell-wall presents the greatest multiformity of shape, the dimensions of the cell are comparatively fixed to a mean of about $\frac{1}{1200}$th to $\frac{1}{1000}$th of an inch in diameter. Its nuclei, however, are more constant in appearance and more characteristic than the cells (LEBERT, BENNETT, PAGET, LAWRENCE). They are always voluminous in themselves, as well as in relation to the area of the cell in which they are enclosed; of a more regular form, being generally oval, or nearly rounded, clear and well defined, with a distinct single nucleus, and rarely two. Their average mean long diameter is from $\frac{1}{2500}$th to $\frac{1}{2000}$th of an inch.

While Lebert attached too exclusive an importance to "a specific cancer-cell," he fully admitted the possibility that the most active and baneful cancers may vegetate through the system without exhibiting any of the cells now described, corroborating in this respect the general statement previously made by Dr. Walshe, "that a tumor may present to the naked eye the characters of encephaloid, and be the seat of interstitial hæmorrhage, affecting the communicating lymphatic glands, run in all respects the course of cancer, and nevertheless contain no cells but such as are undistinguishable from common exudation-cells." Muller, Bennett, Paget, and Lawrence have also since stated the impossibility of distinguishing the cell-element of cancer, as now described, in all cases, from the cells in certain other abnormal and even normal tissues, so that no *single* element can be considered as characteristic of cancer.

The general microscopic characters of cancer-tumors, so far as they can be determined, may thus be summed up as follows:—

I. *The Structure which characterizes Cancerous Growths:*—

1. Nucleated cells—free and not imbedded in any formed interstitial substance.

2. The arrangement of the elements of structure in no defined order—disorder and confusion of elements being the rule.

II. *Microscopic Distinctions of Cancer-Elements:*—

1. Cells of the following characters either compose the tumors alone or are associated with other elements:—

(*a.*) Cells in which the nucleus is very distinct and very large in proportion to the cell.

In size the cells range from $\frac{1}{1600}$th to $\frac{1}{700}$th of an inch in diameter, with a mean of about $\frac{1}{1000}$th of an inch; the cells of the smaller dimensions being usually found in cancers of the quickest growth.

In structure the cell-wall is peculiarly thin and delicate, so as to give the appearance of cell-shaped masses of a soft but tenacious substance enclosing nuclei.

The nuclei are constant as to size and presence. They are large, regularly oval, or nearly round, clear, and well defined. Are not easily altered by decomposition or any usual re-agent. In size about $\frac{1}{2500}$th of an inch. Two nuclei are frequent—more than two are rare.

In form the cells are very various—the outline being linear, angular, or extended in processes.

There is thus great diversity in the elements which compose cancers. The diversity exists alike in the corpuscles, the basis substance, or inter-cell material. The cells are often loosely held together in an abundant, soft, almost liquid substance, as in medullary cancers.

(*b.*) Free round or oval nuclei alone sometimes compose a medullary cancer. They are bright, clear, perfectly defined, largely and often doubly nucleolated.

(*c.*) Nuclei mixed with elongated, narrow, strip-like, caudate, or pyriform cells.

(*d.*) Elongated caudate cells.

(*e.*) Monilliform growths, or jointed and branching cells.

The basis substances proper to cancers are—

(*a.*) Liquid alone; amongst which the cells are suspended, and either infiltrated amongst the tissue or contained in small cavities (*e. g.*, in

cancers of rapid growth). This is "cancer-juice," and may be thick, creamy, yellow, or pink, or of a glairy consistence like synovia or oil.

(*b.*) A framework of granular tissue, extremely delicate, sometimes hyaline, and containing oblong nuclei.

It is important to notice, however, that the "modes of life," development, and growth, rather than structure, should determine whether a tumor is malignant or not. There are cancers *not* formed of such structures as those mentioned, namely,—

(1.) Some fibrous tumors, the clinical history of which is undoubtedly cancerous; also (2.) some osteoid tumors.

The multiplicity of structures composing a tumor is often due to the mingling of cells in various stages of growth, development, or degeneration; or it may be due to disorderly overgrowth and proliferation of cells. When the diversity is due to *development*, overgrowth, or proliferation, nuclei, brood-cells, and caudate cells are characteristic; when due to *degeneration*, granule-masses predominate, or withered corpuscles, with fatty and calcareous masses in yellow parts.

What is supposed to be the blastema or mother-fluid amongst which the cells and stroma of cancers grow, consists of an albuminous synovial-like, colourless, or pale yellowish fluid. It gives rise to the materials which compose the cancer-juice, and to the essential cancer-mass now described—namely, the stroma and the cellular elements. The development of cancer, therefore, proceeds *pari passu* with this fluid as amongst the interstices of textures, or on the free surfaces of the membranes; and lastly, even by endosmosis of the specific fluid into the natural cells of parts (such as into cartilage or bone-cartilage cells), the characteristic cancer-mass may commence to grow by endogenous growth within such cells, hitherto healthy. Dr. Bennett, of Edinburgh, and Dr. Van der Kolk, of Utrecht, have made most interesting observations on the extension of cancers by means of the parenchymatous fluid; and from all that has been observed on this subject, the latter author draws the following conclusions:—

"1. Through an interchange of material, taking place between cancer-cells and intercellular fluid, the latter acquires the property of forming new nuclei and cells of a similar nature.

"2. This intercellular fluid passes, along with the parenchymatous fluid pervading the sound parts, into the textures adjoining the tumor.

The parenchymatous fluid thus acquires the same constituents and tendency to form similar cells, which now become developed among the healthy surrounding tissue, in the course of the areolar membrane.

"3. On account of the minuteness and small number of the last-mentioned cells, their presence cannot be detected with the naked eye; so that the surrounding parts may appear to be perfectly sound, notwithstanding that they contain the germs of the advancing formation of cancer.

"4. It is therefore of importance, in removing cancer by operation, not only to take away at the same time a large quantity of the adjacent ound parts, but also to examine the innermost sectional edges under the microscope, in order to ascertain whether any trace of cancer-cells in process of formation is to be discovered in them.

"5. The existence of burning or shooting pains in carcinoma may be taken as a proof that the cancer-cells have reached the neighbouring nerves, and the disease can then scarcely be looked upon as a local one, in which an operation might be permanently successful.

"6. By the absorption of the infected parenchymatous fluid through he lymphatics and veins, the whole body seems to become more or less tainted, so that secondary cancer ensues in distant situations, when, as is self-evident, operation can no longer be thought of.

"7. This altered parenchymatous fluid penetrates the organic tissues which are washed by it, the sarcolemma of the muscular fibres, the tubes of the nerves, and the like. These membranes, too (both the sarcolemma and the walls of the nervous tubes), appear to take up the altered nutritive fluid; the consequence of which is, that both within the sarcolemma and the nervous tubes similar nuclei and cells arise, accompanied with an absorption of the muscular fibre and of the contents of the nerve, and attended with the deposition of fat, by which these parts waste and are destroyed, while the surrounding membranes (sarcolemma and walls of the nervous tubes) remain" (*Brit. and For. Med.-Chir. Review*, April, 1855).

The cancer-juice is a most important element of the new growth. To the naked eye it appears as a viscid, whitish, creamy, yellowish fluid, which may be squeezed or scraped in considerable abundance from the surface of a section.

It is from the performance of the vital functions by all these elements that we are to draw our conclusions regarding the innocency or malignancy of the new growths in which they form a part, rather than from their anatomical forms. If we find adjacent textures are being infiltrated, poisoning the lymphatic current which passes from them, inducing new growths of a like nature in the lymphatic glands through which these currents pass, affecting

the general system with a peculiar cachexia, marked by languor, debility, emaciation, and a peculiar sallow, leaden-like colour of the skin; and if after removal such growths return, then there is no doubt that the cachexia of cancer is made manifest by such local lesions. These present so many elements in common, that all these new growths are but manifestations of one disease, which has been named "cancer," and attributable to the constitutional cachexia already described. The varieties of this disease also run into one another by characters which are so insensible that definite lines cannot be drawn between them, and thus many species of cancers are described by authors under various synonyms, as shown in the nomenclature adopted by the following authors who have recently written on cancer:—

I.	II.	III.	IV.
Walshe and Bennett (1846-49).	Paget (1853).	Rokitansky (1855).	Lawrence (1856).
Scirrhus, or hard cancer.	Scirrhus, or hard cancer.	1. Fibrous carcinoma.	Scirrhus.
Encephaloma, or soft cancer.	Medullary or soft cancer.	2. Medullary.	Encephaloid.
Colloid, or jelly-like cancer.	Epithelial.	(*a.*) Villous cancer.	Melanosis.
All other forms of cancerous new growths are described by Bennett under the name of *cancroid* growths.	Colloid.	(*b.*) Cancer melanodes.	Nævoid cancer.
	Osteoid.	3. Epithelial cancer.	Villous cancer.
	Melanotic.	4. Gelatinous cancer.	Osteoid cancer.
	Villous.	5. Carcinoma fasciculatum.	Enchondromatous cancer.
	Hæmatoid.	6. Cystic carcinoma.	Colloid cancer.
			Fibrous cancer.
			Fibro-plastic cancer.
			Epithelial cancer.

Of these particular kinds of cancer some tend to affect certain organs rather than others,—for instance, *alveolar cancer* is more frequently found in the stomach or intestines; *epithelial cancer* in the skin and mucous membranes.

The *primary cancer-growth* commences in the textures of some organs rather than others—for instance, in the uterus and female breast, in the stomach, the colon, the liver, the bones, and the brain. *Secondary cancers*, on the other hand, are most frequently developed in the lungs, the spleen, the salivary and lymphatic glands, in the small intestines, and in the serous membranes. But the local aptitude for cancer-growths is a subject unknown. We have no knowledge why one part rather than another should be the seat of cancer; but certain organs seem more liable than others at certain periods of life. For example, before thirty years of age the eye and the orbit are the parts first most liable to be affected, next the bones, testicles, and areolar tissue of limbs and trunk. Between thirty or fifty years of age the penis, uterus, external sexual parts, and breasts. After fifty years of age the integuments and digestive organs are more apt to suffer.

Simple tumors may also become the seat of cancers, just as any part of the body may be the seat of a cancer, although the event is rare. About one-fifth of cancers are ascribed to the effects of injury; and although in many cases the statement may be fallacious, yet the consequences of injury are sometimes too obvious to admit of doubt.

Scirrhus, or *Hard Cancer*, has two stages—a hard stage and a stage of softening. It is a "*cancer characterized by hardness of the primary tumor, and by a tendency to draw to itself the neighbouring soft structures. When ulcerated, the sore is commonly deep, uneven, and bounded by a thick everted edge.*

The local hard or scirrhous state constitutes the first stage. It may grow in *masses*, or may be *infiltrated* into the tissues of the organ or part affected—the latter being by far the most common form. When in masses, they are generally lobulated, dense, and often contained in a cyst; again, when these masses are cut into, we find them to consist of two substances—the one is the cancerous growth, and the other is areolar tissue; so that the appearance of the divided surface in general is that of a hard, white, semi-cartilaginous substance, streaked by fibres radiating from the centre to the circumference. They are of considerable density and firmness, and in hardness of texture vary from hard-boiled white of egg to cartilage—the knife making a grating noise as it cuts through them. The specific weight of these tumors is extremely great; and although in those parts which are external and more or less pendulous, as in the mamma, this fact is, by some distinguished surgeons, an element in diagnosis, our exact information relative to the specific gravity of cancerous growths is still very limited—1·040 to 1·160 is the very wide range which I have observed such tumors to indicate.

The cancerous growth, however, is much more frequently infiltrated among the areolar tissue of the different organs or tissues it affects. In this case the affected tissue becomes gradually increased in thickness and in density by a slow growth of the morbid matter, so that the part, if now divided, presents the same hard, semi-transparent character as in the masses, but more interspersed with areolar tissue, the diseased portion being gradually shaded off into the healthy structures. In the mucous tissues, as those of the stomach or uterus, the infiltrated growth has often a considerable thickness, measuring from a quarter of

an inch to an inch, or perhaps even more. On the contrary, when infiltrated into the cutaneous tissue, the layer is often so attenuated as to be scarcely appreciable, and the disease commences with little other appearance than a small hard pimple, or a small erysipelatous tumor, or even by a slight fissure or crack in the skin.

After a certain but indefinite period, which varies from a few months to a few years, the scirrhous stage of *hard cancer* terminates, and the second stage, or that of *softening*, begins. In mucous membranes this softening usually takes place at their *surface*, or superficially,—as at the mucous surface of the neck of the uterus, or at the mucous surface of the stomach. An ulcer is the consequence of this softened state, and is at first superficial, presenting many remarkable varieties, such as an inverted or everted edge, and an irregular form, while its base may be granulating at one part and sloughing at another. Its course is burrowing, often penetrating between the cancerous lobules, and ultimately may perforate the limiting serous covering, such as the peritoneum. The pus secreted by this sore is fetid; often a mere ichor, or pus mixed with blood, and so acrid as to inflame the parts over which it flows. In a few instances the large vessels participating in the disease ulcerate, and the patient dies of hæmorrhage.

The duration of the scirrhous stage of a cancerous tumor is very uncertain, and may terminate in a few months, or may last several years. A cancerous mammary gland, for instance, has been known to remain indolent for fourteen years, and has at the end of that time been removed by an operation. This indolent character of cancer is limited, however, to the scirrhous stage; for after it has commenced to soften, its course is rapid, and a few weeks or a few months generally terminate the patient's life, the part affected in no instance cicatrizing, or being again restored to a healthy condition.

Medullary Cancer, or *Soft Cancer*, affects more especially the solid visceral organs. It is a "*cancer characterized by a smoothly lobed surface, soft, irregular consistence, great vascularity, and usually rapid growth and reproduction. When ulcerated, it protrudes in large masses, which bleed copiously.*" Its cell-products are most profuse, and its course much shorter than hard cancers, the disease generally terminating in a few months. While hard cancer for the most part affects persons in the decline

of life, soft cancer is most common in its earlier period, or adult age, from twenty-five to forty.

Although generally deposited in masses, it may be infiltrated: the former is the more common form, the latter the more rare. In whichever form deposited, however, it has two stages—namely, one of induration and one of softening. If we examine a soft cancer-tumor in the first stage, we find it composed, as in hard cancer, of fibrous tissue and a peculiar morbid growth. The areolar stroma is of various densities, often extremely fine, and then again of considerable consistency and tenacity, and in either case radiating through the tumor and dividing into lobules. The morbid substance or growth is of many degrees of hardness, varying from lard to cartilage, but is generally softer than in hard cancer: it is of a bluish semi-transparent whiteness. The duration of this hard stage is from a few weeks to two, three, or four months, and only in a few instances does it exceed that latter period. "*Hard encephaloid* is a designation sometimes applied to medullary cancers of unusually firm consistence."

The first stage passed, the process of softening, or of *ramollissement*, takes place. This is evident on cutting into the tumor, and passing the handle of the scalpel over the divided surface, a milky-white substance being expressed. As the disease proceeds, the parenchymatous substance of the new growth is changed into the consistence of soft cerebral matter, or of thickened pus; it is consequently opaque, and varies in colour from white to red, and even black. These variations of colour appear to be owing to the different quantities of blood or of melanic matter which are effused, and with which the cancerous matter is commixed. When bloodless and white, the product is so peculiar that it has been termed *cerebriform*, and when mixed with blood, *medullary sarcoma, fungus hæmatodes*, and many other terms, according to the different quantities of that fluid effused, which is often so abundant that the cyst or cavity at length contains little else than fibrin. "*Fungus hæmatodes is a term applied to some cases of medullary cancer which are more than usually vascular.*"

The process of softening seems to commence indifferently in any part of the tumor, at its centre, or towards its circumference; and if the tumor communicates externally, the quantity of softened matter discharged often amounts to many ounces in the course of the day. This profuseness of discharge appears to be owing

to the great vascularity of the growth; for although in the hard stage only a few blood-vessels, with coats of great tenuity and delicacy, can be traced between the lobules, yet, in the softened state, a successful injection shows the growth to be made up almost entirely of blood-vessels.

The duration of the second stage is generally a few weeks, and very rarely extends to months. It appears, however, that anything which greatly irritates the part accelerates the process of softening. Thus, if a cancerous limb or tumor be amputated, the cancerous matter primarily in a hardened state appears subsequent to the operation in a softened condition, no previous hard stage occurring. The minute organic structure of this form of disease, in its scirrhous state, is probably not dissimilar to that of hard cancer, and of the vital organic characters there can be no doubt of their similarity.

There is scarcely any organ or tissue in which soft cancer has not been found, and by some pathologists the frequency of its occurrence in certain parts is supposed to be in the following order:—the liver, epiploica, the mesentery, the lymphatic glands, the brain and nerves, the spleen, the testicles, the uterus and ovaries, the eye, the bones, the heart, and lastly the blood-vessels. It has been stated that soft cancerous matter far more frequently grows in masses than infiltrates into these parts. In general there is only one tumor; but there may be, as is often seen in the liver, three or four, and in some cases they are extremely numerous. Dupuytren has met with a carcinomatous heart which contained more than 600. In size they commonly vary from a millet-seed to a large egg; but when they form in loose cellular tissue, as between the folds of the mesentery or of the *epiploica*, or in the substance of the lungs or testicle, they have been known to weigh, in extreme cases, 20, 30, 40, and even more pounds. These tumors may also be encysted or non-encysted.

One of the most constant features of this disease, and which distinguishes it from hard cancer, is, that it often appears in many organs or tissues at the same time in the same patient. Thus, it has been met with in the coats of the bladder, in the liver, and in the lungs of the same individual. It has also a greater tendency to be reproduced after an operation for its extirpation than any other kind of cancer. This reproduction may take place either at the part operated on, or in some organ or tissue distant from the primary seat of the disease.

Melanotic Cancer, or *Melanosis*, is a "*cancer* characterized by the *presence of pigment*," and which may be found distributed very generally in every organ and every structure of one and the same body—often becoming first manifest in the soles of the feet or in the axillæ. The lymphatic glands subsequently become affected. Such growths are also found in the ovaries, in the mucous membrane of the bladder and intestines, in the kidneys, supra-renal capsules, heart, and brain. The "*fungus hæmatodes*" have generally been considered related to *melanotic cancer;* and the relationship is more than ever established in the connection which subsists between pigments and the changes which take place in extravasated blood. Frequent hæmorrhages are common in melanotic growths of a cancerous nature, due to extreme dilatation and thinning of the water of the blood-vessels, and the red colour of such tumors must be referred to such kind of vascularity. Pigmentation of such tumors is therefore to be considered as of secondary formation; and in the majority of instances melanotic cancer consists of encephaloid or soft cancer, with the addition of black or brownish pigment. The pigment-deposit, *per se*, is not necessarily malignant. The pigment of cancers is readily decomposed by nitric and other acids, while the *spurious melanosis* or *carbon* is not. The true melanic deposit exists with the soft cancer-cells either as an infiltration into them, or in the form of isolated granules or small corpuscles. The pigmentation may be seen in microscopic sections to take place along the course of dilated blood-vessels. In an early stage the pigment is first contained in cells, whilst later it is found in free granular masses, through the dissolution and disappearance of the cells which contained it, and a gradual transition may in general be traced from the affected part into the normal structure of tissue, where it will ultimately become developed, and which is freely traversed by blood-vessels. Cells of various forms are to be seen in such tumors, which have first a yellow appearance and then a black, according to the amount of pigment deposited in them. The cell-walls subsequently disintegrate, leaving the pigment free.

Colloid, Colloid Cancer, or *Alveolar Cancer*, is sometimes also called *gelatinous* or *gum-cancer*. In this form the meshes of the new growth are filled up by a glue-like or gelatinous substance, like half-dissolved gum-arabic. *It is "a new growth, a great part of which is formed of transparent or gelatinous substance."* The fibrous stroma are arranged in the form of alveolar spaces,

the fibroid tissue being extremely delicate and transparent. The spaces or alveolar loculi vary from a very minute size to that of a pea. The contained substance is of a yellowish or greenish-yellow colour, but yields no gelatine on boiling. The most common places where colloid cancers form are the stomach and omentum, the ovaries, the bones, the kidneys, the uterus, and spleen, and they may be combined with the *hard* or *soft* cancers.

Epithelial Cancer, or *Cancroid Epithelioma*.—Of late years, under these names, or that of *Cancroid*, Lebert, Bennett, Hannover, and Paget have described a form of tumor which has all the vital and malignant qualities of cancer already described, but its minute elements consist of cells resembling those of epithelium or epidermis. It is therefore defined as "*cancer characterized by its occurrence chiefly in parts naturally supplied with epithelium, and by the resemblance of its cells to those of the epithelium.*" It occurs almost solely on the skin or mucous membranes, being frequently seen on the lips or cheeks. Rokitansky has observed it in the liver; Bennett has described it as commencing primarily in the lymphatic glands; and in two cases of what has been termed acute hypertrophy of the mamma, both of which proved fatal with secondary lesions in internal organs, which I examined after death, I believe that this form of cancer was the primary local lesion in the gland (*Med. Times and Gazette* for 1857). It only seems to occur where there is pavement, or spheroidal epithelium. Lebert has seen it on the serous layer of the arachnoid, and Robin has described it on the interior of a vein in a horse. The principal sites are in the vicinity of the great orifices of the body; but the lips, and more particularly the upper lip, are most liable to the development of epithelial cancer. The cancer commences first as a small induration, afterwards a pustule or excoriation forms, and subsequently the deeper parts participate, and determine the form of the growth, which may be mulberry-shaped, villous, cauliflower-like, or nodulated. The surface is apt to become ulcerated at an early period, and an actual loss of substance takes place from the central parts. The resulting open sore has an irregular, grey, and often a bloody base; or it is covered with crusts, from below whose edges a fetid and ichorous discharge may be caused to exude by pressure. When the tumor is cut into at an early stage, the section presents a well-defined border of epidermis, sometimes several lines thick, while the rete

between the surface-layers and the chorion is much hypertrophied. The substance is friable, and is easily separated from the surface of the chorion. The tumor soon tends to take deep root in the substance of the chorion, presenting a white and grey speckled surface, with a basement substance, in which a variable quantity of whitish bodies may be seen, varying in size from a visible point to the size of a millet-seed. The fluid which exudes is milky and granular, and does not mix with water, so as to form such an opalescent, semi-transparent emulsion as the mixture of other cancer-juices with water. It mixes as if it contained fat. The tumor tends to infect secondarily the neighbouring lymphatic glands; and the fatal termination is generally by exhaustion or by putrid infection, when the progress of ulceration is not arrested. The mean duration of cases of epithelial cancer is about six and a half years; and the duration seems to vary with the part as follows:—Nearly three and a half years for the lower lip; three and two-third years for the penis; nearly nine years for the neck and limbs; and nine and a half for the vulva and face (LEBERT, HANNOVER.)

Villous Cancer is a name given to "cancer in mucous membrane, when covered by a villous growth;" and

Osteoid Cancer is a "tumor usually commencing in the bones, consisting almost entirely of bone, and followed by similar growths in the glands and viscera."

Diagnosis.—Cancerous affections of internal parts may be simulated by many nervous disorders, and also by chronic inflammation of the respective parts; but the long continuance of the symptoms, their gradual augmentation, the severe pain, which admits of no permanent relief, together with the loss of health and slow emaciation of the patient, at last give a moral conviction that it must be cancerous growth in some organ from which the patient suffers.

Prognosis.—Cancer, though long latent, and its course slow, pursues its destructive progress unimpeded, and in rare instances does amendment or a return to health await the patient, who ultimately falls an inevitable victim to the disease.

Treatment.—No remedy has yet been found which can in any degree be considered curative of the constitutional state associated with cancer, and the efforts of the practitioner are consequently limited to relieving symptoms, and to the adoption of such pallia-

tive measures as may prolong life. It has generally been believed that to remove a cancerous growth where it is practicable must, on theoretical grounds merely, be attended with as much benefit to the constitutional disease as would attend the removal of a leg for acute rheumatism chiefly expressed in the knee-joint. The statistics of cancer show, so far as they go, and as Dr. Walshe long ago showed, that "excision of a cancerous tumor seems to awaken a dormant force. Cancers spring up in all directions, and enlarge with a power of vegetation almost incredible." Nevertheless, there are good reasons for removing cancers in some cases, especially mammary cancers, and others accessible to the knife. The greatest measure of good may be done, as Mr. Paget has clearly shown, "by making a careful selection of cases fit for operation, and rejecting all the rest as unsuited for operation" (*Med. Times and Gazette*, September 27, 1862, p. 319).

With regard to excision of the breast for cancer, the main objection in the first instance is, that even of cases selected with some care, 10 *per cent.* (PAGET) to 16 *per cent.* (LEBERT) die of pyæmia, or erysipelas, or tetanus, or secondary hæmorrhage, or some calamity subsequent to the operation. On the whole, however, taking the results of some hundreds of cases, it is certain that the average duration of life of those operated on is not less than those in whom the disease runs its course. In well-selected cases it will be found always greater. A recent tabulation of hospital and private cases by Mr. Paget showed that 85 cases operated on lived an average of 55·6 months; and 62 cases not operated on lived an average of three months. It has also been said that the recurrent disease is more painful than the primary one; but in very many cases Mr. Paget has found that the recurrent disease was much less severe than the continued disease. Considering, therefore, the danger of the operation, and the fact that in every case a recurrence of the disease may be expected, is it reasonable to submit a patient to the risk of dying from the primary operation for the sake of that interval of health between the operation and the recurrence of the disease, for the good probability of adding a year to life, and for the chance of having a less severe disease? The average length of the interval before recurrence is little more than *thirteen* months; more than a half return within twelve months; and two-fifths return within six months. The extremes between which

the average is drawn are very wide. In some cases the return may be within *three* months; in others not for *ten, twelve,* or more years.

It is of great importance to determine in what cases the risk of life is greater, and in what the probability of a speedy return of the disease is greater than the average.

The old after 60; the very large breasted in cases of mammary cancer; the fat and plethoric; the cachectic; the overfed on animal food; the drunkards; the gouty; the habitually bronchitic; the albuminurious; the very dejected—not timid merely; in short, those with any organic disease of the internal organs—all such cases are "doubly hazardous" to interfere with by operation (PAGET).

The probability of rapid recurrence is great in acute cancers—*i. e.,* all those that are rapid in their progress—and in those which are observed to increase very quickly before the operation. Great pain, however, is often saved by performing the operation even under such circumstances. In illustration, Mr. Paget records the case of a lady "whose breast he removed when she was five months advanced in pregnancy. She recovered well from the operation, and the benefit procured by its performance was very great. She went to her full term, bore her child, and was able to suckle it for a year before she died, with her most anxious wish fulfilled in comparative comfort."

Another condition unfavourable to operation is a brawny skin, with firm œdema and wide-open hair follicles, or wide adhesion of skin, or in which the skin is cancerous, or where there are scattered tubercles of cancer in the glands and skin; or where there is considerable affection of the lymph-glands in the vicinity, and especially *numerous* diseased glands. A moderate amount of lymphatic disease Mr. Paget does not consider a serious obstacle to an operation. In very chronic cases the operation is needless—where the *breast* is small, shrivelled, knotty, and sunk down on the pectoral muscle. By thus selecting with care, on the one hand, cases fit for operation, and refusing to interfere in those cases in which the operation would be attended with more than a proper share of danger, Mr. Paget believes that the life of a large number of those who suffer from cancer may be considerably prolonged.

In whatever part the disease may be situated, one great rule is to endeavour to restore the healthy functions of that part, and

to alleviate by opiates, chloroform, or chlorodyne internally the distressing pains the patient endures. These remedies are for a time successful, but make no impression on the disease, which silently proceeds, and the patient finally limits himself altogether to opiates. The quantity of opium or other narcotic known to have been taken in such cases is something enormous—five, ten, fifteen, or twenty grains of opium at a dose, or a proportionate quantity of *hyoscyamus* or of *conium*, three, four, or more times in the twenty-four hours. But although these large doses have occasionally been given, yet it may be questioned whether they are not more hurtful than beneficial; for usually they produce headache, delirium, loss of appetite, and narcotism, so that the patient is only the more rapidly exhausted. In general, therefore, the patient does better under moderate doses of opiates, as one or two grains, or its equivalent of morphine or other narcotic, every four, six, or eight hours, than when more excessive doses are given—a larger dose producing headache and much cerebral disturbance, without in any sensible degree mitigating the sufferings.

When the disease is seated in the colon or intestine, the tumor is in general difficult to make out. One loop of intestine may open into another; and death by hæmorrhage may terminate the case. The symptoms vary greatly according to the position of the cancer and the part of the intestinal canal affected. Great sickness and vomiting generally attend cancer in the duodenum.

When the stomach is so irritable that it rejects everything, it is our duty to support the patient by nutritive injections, as of strong broth, egg-flip, sago, or other fluid substances. It has been attempted to impart strength to the patient by means of milk baths, or baths of strong broths; but the skin has not generally sufficient power of absorption, and it has been found that the heat of the bath has exhausted the patient in a far greater ratio than its nutriment supported him.

As a general principle, diet has little or no influence over the course of the disease, when once established, so that whatever agrees with the patient's digestion may be safely indulged in.

Preventive treatment must be directed to the infant life of those who are hereditarily predisposed.

CHAPTER III.

PATHOLOGY OF THE SCROFULOUS ORDER OF CONSTITUTIONAL DISEASES.

THE diseases belonging to this order are more strikingly wasting in their effects upon the body than those which belong to the order now just described. They comprehend more especially *scrofula*, either with or without *tubercle, tabes mesenterica, phthisis pulmonalis*, or *pulmonary consumption, acute miliary tuberculosis, tubercular peritonitis, tubercular pericarditis*, and *tubercular meningitis*, or *hydrocephalus, scrofulous ophthalmia*, and *scrofulous iritis*. Many of them are characterized by the growth of a peculiar substance in the tissue of some organs rather than in others, to which the name of *tubercle* has been given. These growths occur in the tissue of the alimentary canal; in the peritoneum, arachnoid, or pleura; in the lungs, liver, spleen, or kidney; in the tissue of the lymphatic glands, especially the cervical, inguinal, and mesenteric glands; and sometimes in the pancreas and the tonsils.

In other respects these diseases are very similar to those of the order previously described, owing their existence to constitutional conditions; and in the present state of our knowledge they ought not perhaps to have been formed into a separate order: for there can be no doubt that in the *tubercular* or *wasting* diseases, as well as in those of the *diathetic* order, there is a *latent* condition existing before the tubercles are apparent. The relation of the nutritive and other morphological changes between the solids and the fluids of the body has everything to do with the development of the scrofulous state. In cases where the tendency to the growth of *tubercles* is hereditary, the operation of agents from without act as stimuli or excitants to the growth of them.

Previous to 1829, when Sir James Clark published his classic work *On Climate*, the tendency of pathological researches into the nature of the diseases just mentioned was to keep up the idea that these diseases, and especially *pulmonary consumption*, were merely local, and referable to a local cause.

The terms *phthisis, consumption*, or *wasting*, were originally used vaguely to designate a variety of chronic diseases, described

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entirely by local symptoms and physical signs, and therefore having few characters in common, except the marked emaciation which attended them. When researches in morbid anatomy became more frequent and efficient, the local lesion most frequently connected with the phenomena of wasting was discovered to be a peculiar morbid condition of the lungs, and to this the name of "*consumption*" was applied, and afterwards more definitely "*pulmonary consumption.*" From the frequency of this local lesion the pulmonary state of necessity attracted far greater attention than any other form of disease in which *wasting* was a marked feature; and when lesions in other organs were found associated with "*pulmonary consumption,*" they were regarded as complications rather than as local manifestations of one and the same general constitutional state, and were looked upon as the primary cause of the emaciation. In 1819, Laennec first showed, by his accurate *post-mortem* observations on the state of the lungs, that growths to which the name of "tubercles" were applied formed almost the sole cause of *consumption*, and consequently he restricted the term *phthisis* to "*the disease produced by tubercles* in the lungs. Louis and Andral confirmed the observations of Laennec; and thus the view of this morbid state, based as it was on morbid anatomy *alone*, led to the enunciation of limited and erroneous doctrines regarding the real nature of the disease which the existence of *tubercles* indicates either in the lungs or in any other part of the body. The relations subsisting between *pulmonary phthisis*, *consumption*, or *wasting*, and the occurrence of "tubercle," must now be even still more modified under the combined researches of morbid anatomy and progressive knowledge in pathology. *Consumption*, or wasting, in the common acceptation of the term, is not now to be found due always to tubercle (ADDISON, GAIRDNER, REINHARDT, VIRCHOW, JENNER, and MACLACHLAN), so that the terms *phthisis* and *tubercle* cannot now be considered always as synonymous. Ulceration of the lungs and partial destruction of pulmonary tissue are now found to arise from other causes than the existence of *tubercles*, which become equally efficient causes of phthisical mischief (BAYLE, ARMSTRONG, GRAVES, STOKES, and MACLACHLAN). Nay, we know also that many states of the body to which the name *scrofula* or *struma* is applied are not necessarily attended with "tubercles" at all; yet, when the local lesions

of a tubercular nature are observed to be connected with marked constitutional states under various circumstances, the connection between the *tuberculous* and the *scrofulous* state is seen to be of the closest description, and their pathological history is now generally believed to be identical.

The extensive observations of morbid anatomists since the time of Laennec, elucidated by the most learned pathologists of the age, now tend to establish on a very broad foundation the doctrine first so strenuously and ably advocated by Sir James Clark, that the morbid conditions now mentioned are due to what he termed a "tuberculous cachexia;" and accordingly it is proposed to consider the *constitutional* disease, of which the occurrence and growth of "tubercles" is but a local expression, under the general title of SCROFULA, of which the varieties are (a.) *Scrofula with tubercle;* and (b.) *Scrofula without tubercle;* and the local scrofulous affections are those named on p. 188.

CHAPTER IV.

DESCRIPTION OF THE SCROFULOUS ORDER OF CONSTITUTIONAL DISEASES.

THE CACHEXIA ASSOCIATED WITH THE SCROFULOUS STATE, OR SCROFULA.

LATIN EQ., *Struma;* FRENCH EQ., *Scrofule;* GERMAN EQ., *Scrophulose;* ITALIAN EQ., *Scrofola.*

Definition.—*A particular morbid condition of the system, attended in active or acute forms of the disease by a persistent increase of temperature, followed by a continuous wasting of the body and the growth of a substance in various tissues and organs, especially the lungs, to which the name of "tubercle" or "tuberculous matter" has been applied;—or, without the deposit of tubercle, these febrile phenomena are associated or preceded with peculiarities of outward appearance during life, and liability to certain diseases termed "scrofulous," such as swellings of lymphatic glands and of joints, carious ulcerations of bones, frequent and chronic ulcers of the cornea, ophthalmia,*

abscesses and cutaneous pustular eruptions, persistent swelling and catarrh of the mucous membrane of the nose, and characteristic thickening and swelling of the upper lip—lesions which, while they are distinguished by mildness of symptoms, are peculiarly persistent, characterized by specific forms of inflammation or ulceration, and follow on the application of exciting causes which would have no effect on a healthy person.

Pathology.—The *diathesis* which expresses the latent existence of the state now defined has been variously described by the terms *tuberculous, scrofulous,* or *strumous diathesis.* There is perhaps no subject in the whole range of medical science which the student ought to study more carefully than the cachexia associated with the occurrence of tubercle and *scrofulous affections.* As a practitioner he will find that he becomes often painfully concerned in the deepest interests of families and society, through the threatened or actual ravages of scrofulous diseases. The extensive prevalence of the scrofulous cachexia—the great and almost inevitable mortality of the scrofulous diseases themselves, when completely developed, stamp the morbid state associated with them as a topic which at the outset of the student's career ought to engage a large share of study. Most assuredly the physician will have to turn his knowledge of the pathology of scrofula to account in every phase of his professional life; nay, further, when he knows, what experience has now adequately demonstrated, that the scrofulous cachexia springs from causes over which the public, rather than the medical profession, have control, he must be at once impressed with the belief, and encouraged with the hope, that when he acquires the confidence of the public in the practice of his profession, he may exercise a powerful influence for good in teaching how much they may themselves control the ravages of *consumption* by prudent marriages, sanitary attention to offspring, and the necessity of free ventilation and of fresh air in places inhabited by man.

There are several circumstances which show the great influence of public sanitary measures in controlling the ravages of consumption and scrofula, when these measures are scientifically directed to the preservation of the general health, and especially when men are associated together in great communities — an influence much greater than the best directed efforts of the medical profession can establish through their *materia medica.*

It is by the mode of life as citizens of the world, in the social relations of husbands and wives, parents and children, and in the public relation of masters and workmen, that the extent and ravages of consumption and scrofula are to be controlled. It is by a strict attention to the rearing of offspring, and in the subsequent regulation of food, clothing, cleanliness, occupation, the choice of a profession, and by many other circumstances which have an obvious influence (perhaps at first sight inappreciable) on the maintenance of the general health, that our hopes of success as practitioners of medicine must rest in the prevention of that bad habit of body which develops and propagates the scrofulous diseases in civilized society.

When Sir James Clark, in 1835, published his treatise on pulmonary consumption, he expressed some doubts as to tuberculous diseases being comparatively more prevalent at the time he wrote than they were some fifty or a hundred years before. He was also of opinion that while many circumstances favoured the probability of a diminution of tuberculous diseases, there were circumstances which might materially counteract such an influence; and while he was convinced that tuberculous diseases had increased in the middle and upper ranks of life at least, he believed that, as a rule, the constitutions of the three past generations had deteriorated progressively from father to son.

The annual returns of our Registrar-General up to 1846 show a progressive increase in the mortality from consumption. In 1854, however, we find it recorded "that phthisis is twice as fatal as any other disease in England, but that within the last eight years it appears to have declined to some extent." The inquiries of Dr. H. Greenhow show that this diminution is in a great degree due to those hygienic measures which have contributed to diminish the causes of the *miasmatic* order of ZYMOTIC diseases in general; and which have especially lessened the prevalence of those *febrile exanthematous diseases* which, by weakening the constitution, tend to bring about those conditions under which that bad habit of body is established which leads to the growth of tubercles and the development of scrofulous affections. To no kind of sanitary measure are we more indebted for this result than to the influence of vaccination in diminishing small-pox—a disease which, of all others, seems to have tended to the development of the scrofulous cachexia as a sequel to its

existence. Accordingly we find it recorded by Dr. Greenhow that "during the middle of last century, before vaccination was known, the scrofulous death-rate was more than five times as great as our present one; and the pulmonary death-rate of the present time is 7 *per cent.* lower than the pulmonary death-rate of 1746-55."

While, therefore, such statements and careful observations, extended through long periods of time, show how much may be done by general sanitary measures in preventing the extension of scrofulous diseases, there is still great necessity for a careful study of the nature of these diseases, for we find them in reality *decimating* the civilized part of the world, cutting off in some instances as many as 35 *per cent.* of our metropolitan populations, and a much larger *per centage* of the army.

Morbid Anatomy of Tubercle.—The peculiar growth (erroneously called a deposit) which sometimes attends the diseases now under consideration is named *tubercle* from its external form, occurring as it does in small nodules, isolated or grouped together, or as large irregular masses, dispersed through the textures of an organ. One essential character of *tubercle* is its incapacity to development beyond the state in which it first becomes visible, and in which state it may remain latent. It generally, however, exhibits a tendency to degenerate in various ways, involving with such degeneration the destruction of the tissue with which it is surrounded. It contains no trace of fibrous development (ROKITANSKY). The term *tubercle* is always understood to refer to adventitious masses of this nature, the type of which is found in the lungs as the essential anatomical constituent of pulmonary consumption. But the same material which composes *tubercles* in the lungs is also found in many different forms in other organs; and wherever it occurs it is described as *tubercle* or *tuberculous matter;* and *tuberculous disease,* or *tuberculosis,* is the usual designation of the specific malady of which the essential feature is the production of this peculiar matter (PAGET). A review of the opinions of recent writers, by Dr. Jenner, as to the nature of *tubercle,* in *The British and Foreign Medico-Chirurgical Review* for January, 1853, shows that the most eminent pathologists of the day are not at one as to the nature of this morbid product. "The opinions entertained regarding the nature of *tubercle,*" writes Dr. Jenner, "may be divided broadly

into two classes." One class of pathologists holds that tubercle is an exudation essentially morbid in character (ROKITANSKY, BENNETT, ANCELL, LEBERT). Another class holds that tubercle is merely a retrograde metamorphosis of pre-existing structures, tissue-elements, or morbid products (WILLIAMS, REINHARDT, HENLE, GULLIVER, ADDISON).

Virchow may be said to hold a doctrine combining both views. For, while he holds that tubercles are essentially composed of dead tissue-elements, whether these are physiological or morbid products, he also holds that a local process in all cases leads to an exudation of a material which is poured out during what he terms "a tuberculous inflammation," and which becomes organized to a certain extent, and then dies, breaks up, shrivels, and so becomes tubercle. This process Virchow calls *tuberculosis;* and *scrofulosis* is the general constitutional state in which this *tuberculizing* process occurs, and which commonly leads to *tuberculosis;* or, in the words of Paget, "the relation between the two (terms) is, that the *scrofulous* constitution implies a peculiar liability to the *tuberculous* diseases." According to Virchow, *tuberculosis* is the local process in scrofulous affections in which there occurs an exudation of a material, nutritive or pathological, which develops into cells, and that these cells *tuberculize*, or undergo the tuberculous metamorphosis. *Tuberculization* is therefore the local process by which the metamorphosis of the elements of a part into tubercle is effected by endogenous development, atrophy, shrivelling, and desiccation of its textural element.

A *tubercle* is thus formed of the detritus of the metamorphosed and atrophied cells, with the remains of the vessels and other structures of the part in which they were seated (JENNER).

Whatever may be the view entertained regarding the exact nature of *tubercle*, this morbid product appears to us under two conditions, in forms more or less spherical, the contour of the masses being influenced—(1.) By the nature and movements of the surrounding tissue; and (2.) By the form of the part in which it first accumulates. The more recent and accurate microscopic observations which have been made into the nature and seat of the tuberculous deposit serve but to establish and confirm the more crude but scientific generalization made by the late Sir Robert Carswell, when he wrote that "the *free surfaces* of mucous membranes form the chief seat of tuberculous deposit."

It is necessary, however, to extend the significance of the term *free surface*, and make it now apply to the ultimate and microscopic *cul de sac* terminations of mucous tubes.

Grey and *yellow* tubercle-masses are the names by which such deposits are described, and they are first visible in the form of roundish granulations about the size of millet-seeds, and isolated, or in groups of nodular masses of more or less irregular form.

The *grey tubercle* is tough, soft, and compressible, of a pearly-grey colour, and semi-transparent. Microscopically, it is seen to be composed of irregular-shaped bodies, approaching a round, oval, or triangular form, and varying in size from $\frac{1}{4000}$th to $\frac{1}{2000}$th of an inch. These sometimes appear to be imbedded in a hyaline adhesive basis-substance, infiltrated with granules and molecules varying from a point scarcely measurable in size to the $\frac{1}{6000}$th part of an inch in diameter. The most characteristic semi-transparent grey granulations appear to contain more of the hyaline basis or connecting substance than of formed elements, the whole field of view being more transparent, and the elements less well expressed or defined. Acetic acid (weak, one part to four or six of water) dissolves many of the granules, and renders all the corpuscles more transparent, while a solution of potash completely dissolves them.

Various opinions are entertained as to whether or not *tubercle-masses* ever consist of *tubercle-cells* with *nuclei*. Rokitansky holds that there are cells present containing one or more nuclei, and which indicate an endogenous development and growth of the elements just noticed. Gulliver and Vogel believe in the existence of such nucleated cells; Bennett, on the other hand, has never been able to discover nuclei in the corpuscles of tubercle. By many these cell-like elements are described and believed to be nuclei (Bennett, Schroeder Van der Kolk, Rokitansky, Paget, and Sieveking); and the view now related as entertained by Virchow, how existing tissue-elements may tuberculize, renders it highly probable that they may be the nuclei of epithelial cells, as suggested by Van der Kolk, or of other cell-elements, normal or pathological, as believed by Virchow; or they may be cell-particles, like nuclei, of slow formation and without any tendency to reproduction, but tending to disintegrate or break down into molecules, as described by Bennett. Paget enumerates the elements of tubercle as follows:—

"1. Molecules, granules, and oil-particles, usually of small size and extremely predominant in *yellow tubercles*. 2. Nuclei of cytoblasts of various shapes and structure, but all degenerate or defective; some glittering, hard edged, wrinkled, and withered; others granular; and few or none with distinct nucleoli. 3. Nucleated cells, similarly misshapen, withered, or granular. 4. Certain compound cells, as described by Van der Kolk, and consisting of epithelium charged with the nuclei which become the common tubercle-corpuscles."

When the masses of grey tubercle exist in the substance of the lungs, their resemblance to millet-seeds has sometimes procured for the deposit the name of miliary tubercles; and when the lung is cut through, the elastic nature of its texture causes it to contract upon itself, so that the parenchyma recedes from the tubercle-deposits visible on the surface of the section, and the deposits appear slightly raised from the cut surface, and the finger may feel them as little resisting bodies set in the lung (PAGET). When examined with a moderately magnifying hand lens, the borders of these masses are seen to be irregular, with short projecting processes. The contraction of the lung and the consequent squeezing of the *tubercle*-mass, probably render these appearances secondary forms assumed by the grey granulations.

Yellow tubercle is of various shades of colour, and occurs in masses of variable size, generally larger than the *grey* deposits. These masses are opaque, friable, and of a cheesy, lardaceous consistence. The masses of yellow tubercle are more commonly grouped so close together that the movements of the lungs cause them to become fused in uniform tubercular masses half an inch or more in diameter. Microscopically, *yellow tubercle* contains a much greater abundance of fine molecules than the grey tubercle, and there are also present in it elements similar to those in grey tubercles, which are shrivelled, indented, and wrinkled. There are thus no positive or characteristic morphological elements in tubercle, and the pathologist is therefore obliged to make the microscopic diagnosis of tubercle by a process of exclusion or elimination. For example, if he finds that the substance he is examining consists of the elements just enumerated, and that there are *no blood-vessels nor blood-spaces* in its interior, and that there is nowhere in it any fibrous matrix enclosing cells, he is surely dealing with a tubercular formation. But, on the other hand, if he finds, besides these elements, a fine vascular pro-

vision for its nutrition and growth, with cells of a fully developed kind, and others degenerating, with blood-spaces, and having an areolar matrix-tissue, then he is most probably dealing with a malignant infiltrating growth, or a pneumonia in the lung, between the gradual invasion of which and tubercle there are points of analogy as well as of difference. The walls of the pulmonary artery are thickened in both; also the lining membrane of the bronchial tubes. In pneumonia, also, as well as where tubercle is being developed, the air-cells are increased in capillary action, followed by obstruction and breaking up of tissue.

The developmental origin of tubercle is to be sought for, in the first instance, as a growth from the elements of the surrounding tissue, nourished by the adjoining capillaries; and if an exudation of a fluid kind is present, its infiltration assumes the granular form of albuminoid elements, and is incapable of further growth, but capable of receiving a deposit of earthy salts in its substance, or of otherwise degenerating.

The fatty degeneration of tubercle seems to be a subsequent process, associated with a softer state of the mass in which the organic cell-elements still remain. To this oily or fatty degeneration is due the *yellow colour* of tubercle; and hence, also, this yellow form is regarded as a secondary form to the grey granulation. It is in reality a degeneration or retrograde change. And this oily degeneration is not so favourable a local change as that by which the tubercle already formed wastes and *dries up*, while its further development ceases, and the mass assumes a cartilaginous-like consistence. At the same time calcareous salts are deposited in the mass, which then hardens or cretifies.

In the *grey tubercle* this salutary change is uniform throughout the mass; in the yellow tubercle the calcareous salts are usually found in larger amount round the peripheric portion of the tubercle, closing in a pultaceous friable substance, composed of free fat-granules, aggregated globules of fat, brown or black pigment-masses, and plates of cholesterine.

Vogel, Wedl, Virchow, and several other first-rate observers, are agreed that "an organized new formation constitutes the basis of the pathological structure known as tubercle."

To verify this the study of tubercle as a morbid growth ought to be commenced with the serous membranes, as in the arachnoid or pleura. In these textures we are not so apt to regard half-

destroyed tissues as new products—a risk we always run in the examination of pulmonary tubercle.

Few objects of morbid anatomy have been submitted to more minute research than "tubercle;" and there is scarcely any organ where the growth may not occur. Considerable differences of opinion have been entertained respecting the relation of the two varieties of tubercle which have been described. Laennec taught, and it has been the general belief since his time, that the *grey tubercle* is the earliest stage of the deposit which subsequently becomes converted into *yellow*. Dr. Walshe has also especially investigated this point, and teaches a similar doctrine. Rokitansky, in the first edition of his great work on morbid anatomy, regarded the *yellow* and the *grey* as essentially distinct forms, and considered it an error to believe that the one is converted into the other. Rokitansky now affirms that *grey tubercle* is sooner or later converted into *yellow tubercle*, as Laennec first taught, and which is now the common belief. When the grey tubercle does not pass into the yellow, it withers away. It loses its lustre, and becomes dry, dense, and hard, and shrivels into an indistinct shapeless fibrous-like mass. Sometimes such a change is associated with a calcareous degeneration, the surrounding tissue in which it is imbedded becoming dark with the deposit of pigment.

It is now believed and taught by Rokitansky, Virchow, and others, that certain abnormal products, not apparently at first tubercular, afterwards *tuberculize*, and assume the appearance of yellow tubercles. To this change Virchow proposes to restrict the term "*cheesy metamorphoses.*" The metamorphosis of *grey* to *yellow* tubercle generally commences in the centre of the growth, and subsequently the yellow tubercle undergoes most important secondary changes in a sanative point of view. These changes consist—(1.) in softening; (2.) in cretification or calcification; but it is not to be understood that the first of these two changes always passes into the second.

The descriptions already given, and the metamorphosis about to be noticed, illustrate the distinctive and peculiar characters of tuberculous growth—namely, its early degeneration and abortiveness. It seems to be a substance which acquires a certain stage of organic development, when it is arrested in its course, recedes, and degenerates. Such characters may be read from the shrivelled

or granular state of the so-called free nuclei and the barren cells. The changes about to be noticed show a still more retrograde decay (PAGET).

When tubercle softens, its substance breaks down into a tolerably uniform creamy pus-like fluid, in which are to be seen an immense number of fine granular points or molecules. The basis-substance appears to soften first; but in some kinds of softening much of the corpuscular forms are retained in a thin, whey-like, flocculent fluid, approaching in character to what is known as scrofulous pus, both microscopically and to the naked eye. The softening appears on the whole due to the breaking up of the corpuscular elements, as well as of the basis-substance. When softening begins in the centre of the yellow crude masses, it leads one to believe that fluid may transude from the surrounding effusion or hyperæmic state, and penetrate to the centre of the whole mass, where it may accumulate and increase the softening, without becoming developed into the visible cell-elements of tubercle. As each tubercle or group of tubercles undergoes this softening process, the softened mass occupies a cavity, which thus becomes an abscess, though not a purulent one, and the tissue involved by the growth of the tubercle is destroyed. It dies with the increased growth and softening of the mass. During this process of softening, tuberculous matter continues to grow in other portions of the organ, and when it occurs in the lung, generally from above downwards, so that excavations or cavities are found at the apex of the lung, while lower down yellow tubercle-masses, beginning to soften, exist; and still lower down the *yellow tubercle* is found in a crude state, as if newly changed, or in the process of being changed from the grey granulations which are disseminated through the base of the lung.

Pathologists are now agreed that the production of tubercle is quite independent of inflammation, in the ordinary acceptation of that term, implying thereby the presence of pain, heat, swelling, redness, lymph, or pus; but that in the great majority of cases inflammation is set up round the tubercle-masses, and plays an important part in promoting further growth of tubercle, which proceeds in a rapid course to softening and destruction of tissue. The phenomena of the growth of tubercle are also associated with the existence and supply of material which forms the fibrous thickenings and capsules around tubercular cavities or ulcerations.

These phenomena also bring about the separation of the tubercle-mass from the surrounding parts, and if it is eliminated in any way, a cavity or an ulceration remains. When thus enclosed by fibrous thickenings or capsules, the softened tubercle may undergo the process of *cretification* or *calcification;* in other words, it becomes converted into a greasy, fatty, chalky mass, which gradually becomes hardened into a brittle substance. There appears to be either a deposit or a liberation of calcareous particles in the mass, for the elements become mixed up with gritty particles of earthy salts; and at the same time there is absorption of the animal part, so that the original size of the tubercle-growth is diminished. When tubercle is thus completely calcified, a thin section presents a granular appearance, but with no definite forms, combined with more or less pigment.

Tubercle has been analyzed by many chemists. The analysis by the late Dr. R. M. Glover, of Newcastle, appears to be the most accurate and extensive.* His conclusions are as follow:—

"1. That tubercle consists of an animal matter mixed with certain earthy salts.

"2. That the relative proportion of these varies in different specimens of tubercle. That animal matter is most abundant in recent, and earthy salts in chronic tubercle.

"3. That the animal matter certainly contains a large amount of albumen, while fibrin and fat exist in small but variable proportions.

"4. The earthy salts are principally composed of the insoluble phosphate and carbonate of lime, with a small proportion of the soluble salts of soda.

"5. That very little difference in ultimate composition has yet been detected between recent tubercle and the other so-called compounds of protein."

Thus much is known regarding the histology of tuberculous growths, and is here stated minutely, because we have the testimony of most experienced morbid anatomists, such as Bennett, Paget, and many others, that the microscope alone can decide as to the nature of those which closely resemble tubercle when examined by the naked eye. Indeed, such are the vague

* This analysis, to be satisfactory, should be made on tubercles at different periods of life. The tubercle of the *young* strumous subject is believed to differ greatly from the tubercle-growth found in *advanced life*, especially in a gouty habit.

definitions given of *tubercle*, that, in the words of Bennett, "every morbid anatomist must frequently have experienced much difficulty in endeavouring to determine by the naked sight whether a certain morbid product be or be not tubercle."

Nomenclature.—The term "tubercular deposit" can scarcely be regarded as correct, although in common use. The expression ought rather to be "scrofulous or *tubercular form of inflammation;*" just as we have been accustomed to use "tubercular meningitis" as synonymous with "scrofulous tubercular inflammation of the meninges."

In the *peritoneum* the seat of scrofulous inflammation is immediately beneath the serous coat, where sanguineous congestions and minute extravasations first take place during the rapid formation of the tubercular granulations.

In the *mucous membrane* of the alimentary canal the seat of scrofulous inflammation is principally in the lower part of the small intestines. The tubercle grows originally in the submucous tissue, and elevates the mucous membrane stretched over the granulations. They project in the form of nodules assembled together in several groups. New granulations spring up between the older ones; and as these growths degenerate and soften rapidly in the intestines, a fusion of the whole very soon takes place. The circulation in this part of the intestine is impeded, and its vitality is gradually destroyed; its mucous membrane is lost, and ulcerations form, whose shapes are decided by the form of the original growth. Thus:—A single tubercle-nodule gives a crater-like ulcer. A number produces extensive ulceration, with irregularly excavated borders, the growth of the tubercle-masses being continued at the margins of the ulcers; and hence the thick border, with particles of yellow crude tubercle imbedded in it, so characteristic of these ulcers. Similar material may also be seen on the floor of the ulcers, the softening of which leads to perforation of the peritoneum.

A considerable portion of the scrofulous exudation may transude in a fluid state, in the first instance, through the capillaries, and collect in those places outside the vessels that offer least resistance (Bennett). While, therefore, *infiltration* more or less extensive, as described by Baillie, is the first condition in which the exudation can be observed to exist, *tubercle* may be observed to accumulate on the free surfaces of mucous and serous membranes,

or on the outer surface of minute blood-vessels. While, therefore, scrofulous material does not differ in its seat from the simple or cancerous exudations, when these form minute growths in the lungs or other parts, yet there is an important difference in regard to their relation with the blood-vessels, which requires to be specially noticed. It was first pointed out by Dr. William Stark that when attempts are made to inject a tuberculated lung, the finest injection will not reach, far less penetrate, the *tubercle-masses.* Blood-vessels which are of a considerable size at a little distance from tubercle-masses speedily become contracted, so that a large vessel, which at its origin measured nearly half an inch in circumference, could not be cut open further than one inch, and that when cut open, such vessels presented a very small canal filled by a coagulated substance. Schroeder Van der Kolk made similar experiments. He sometimes found that large vessels remained pervious which crossed a tuberculous cavity in a lung, but that all the small or capillary branches which adhered and were given off from the larger trunks were obstructed and impervious. These observations lead to the conclusion that obliteration commences in the smaller vessels and proceeds to the larger trunks; and are of some importance with reference to the process of softening, and other changes which are observed to take place in this *non-vascular* growth. The process of *softening* is not so uniform in its progress as the notice already given might lead one to suppose.

It appears difficult in every instance to ascertain at what part softening commences, so that it is incorrect to give a general description of this change as always commencing in one place. In one case it may begin in the centre and proceed to the circumference of the growth; in another it may begin at the circumference and go round the whole mass, detaching it from the surrounding textures; in a third case it may begin at once in the centre and at the margins; and in other instances it has been observed to commence at the same time in several parts of the substance of the tubercular mass; and this is especially the case where the masses are large (CRAIGIE, BENNETT). The portion or spot about to soften loses its firmness and becomes friable, the cells swell and break up, adding thus by their solution to the diffluency of the mass. Inspected with a common hand lens, the mass seems as if perforated here and there with holes, and

this softening extends by degrees throughout the whole growth. The air-vesicles necessarily are destroyed by this process, and the terminal extremities of the bronchi are amongst the first structures to suffer. The mucous membrane which covers them is red and villous in the vicinity of the softened part, and as tuberculosis proceeds, the whole of the pulmonary mucous membrane presents the anatomical characters of chronic bronchitis. The softening of the growth and the inflammation of the textures seem to act and re-act upon each other; liquefaction seems to extend more rapidly when local inflammation is set up, and the softenings, on the other hand, appear to augment the local re-action.

Constitutional Origin of Scrofula.—Departing from the limited consideration of the subject which *morbid anatomy alone* affords, clinical and pathological research tends more and more to confirm the belief in the constitutional origin of scrofula. There is undoubtedly a predisposition to scrofulous growths, either hereditary or acquired; and that there is a bad habit of body—a cachexia—which precedes the development of tubercle, no one can deny.

The development of tubercles, wherever found, is undoubtedly a local lesion which indicates a *constitutional disease.* It has been hitherto, however, the custom to name the local lesions as the *disease,* rather than to describe the constitutional state. Thus, when the lesions have been most marked in the bones and glands, the name of *scrofula* has been given to the condition; when the lungs are the site of the deposits, *phthisis* or *consumption* is the name by which the condition is familiar; and when in the glands of the mesentery, it has been called "*tabes mesenterica;*" and in the meninges of the brain it has been named "*hydrocephalus,*" or "water in the head." The constitutional disease under which all these affections are now comprehended is named "scrofula," and is shortly defined as "*a constitutional disease resulting either in the deposit of tubercle or in specific forms of inflammation and ulceration,*" as stated in the second part of the definition previously given.

The changes in the general system by which the scrofulous cachexia is brought about are apparent in the physical condition of the patient, and in the exercise of some of the vital functions especially connected with nutrition. To the late Dr. Tweedy

Todd, Sir James Clark, and Professor Bennett, the profession is principally indebted for the clear and earnest elucidation of *scrofula* or *tuberculosis* considered as a constitutional affection; and on our knowledge of it as such rests our only hope of success in the prevention and treatment of this most formidable scourge of civilized society.

Many observations have been made and statements recorded with the view to connect scrofula with morbid states of the blood, but hitherto no constant morbid condition of the circulating fluid can be said to be peculiar to the disease. As Dr. Bennett observes, we must look to something beyond—we must look to the pabulum which ministers to the nutrition of the body itself through the blood; for with an impoverished state of that fluid there is doubtless an impoverished state of the tissues. But there are some curious and detached observations which, when connected together in certain pathological relations, appear to throw more light on the nature of the constitutional state which leads to the development of scrofula than any single observation of individual authors. These I would thus shortly enumerate:—

1. There is to be noticed the albuminous character of the fluid material which infiltrates the tissues of an organ previous to the process of *tuberculization*, by which this infiltration is in part changed by coagulation into *grey tubercles*, each of which may block up from three to twenty air-vesicles in the lung.

2. There is in some cases, as shown by Drs. Alison, Williams, Bennett, and Rokitansky, an obvious affinity between the lymph of the blood and tubercle.

3. There is an albuminosity or venous state of the blood which is considered by some as peculiar to the scrofulous state of the constitution.

4. There is the peculiar state of the blood, amounting to an appearance of leuchæmia, which immediately succeeds digestion in healthy persons, as observed and described by Dr. Andrew Buchanan, of Glasgow, in *The Transactions of the Philosophical Society* (vol. ii.) of that city, resembling the molecular and corpuscular elements of chyle or lymph, and consisting of fat emulsionized with albumen. To this substance he gave the name of *pabulin*, and which is still further elaborated in the blood, in the glands,

and in the lungs, before it takes part in the general morphological changes connected with nutrition.

5. The observations of Dr. Acherson, of Berlin, and of Dr. Bennett, relative to how nutrition may be impeded by diminishing the *molecular* state of the nutritive elements, and improved by increasing them.

6. The observations of Panum and Parkes relative to the precipitation of albumen by acids and neutral salts, in which Dr. Parkes especially shows that the albumen as it exists in the serum of the blood is usually in that condition in which it is most easily precipitated by acids and chloride of sodium (*Med. Times and Gazette*, July, 1850 and 1852).

7. The excess of intestinal acidity in the alimentary canal of phthisical patients, as shown by Dr. Bennett, by which, under some conditions, the albuminous constituents of the food are rendered easily soluble, whilst the alkaline secretions of the saliva and the pancreatic juice are more than neutralized, and so rendered incapable of transforming the carbonaceous constituents of food into oil, or of so preparing fatty matters introduced into the system as will render them easily assimilable. Hence an increased amount of albumen enters the blood compared with fatty elements.

According to the observations of Mr. Jonathan Hutchinson, acid eructations were present in 62 *per cent.* of the cases of dyspepsia which preceded the deposition of tubercle, and were a prominent symptom in 46 *per cent.* of cases reported on by him in an admirable paper on the forms of dyspepsia preceding and attending phthisis (*Med. Times and Gazette*, vol. x., 1855).

Any one of these statements considered by itself does not seem of much importance, but considered as a whole, in their relation to nutrition and their influence upon morphological changes between the solids and the fluids of the body, they leave very little room for doubt that the bad habit of body in scrofulous affections associated with the growth of *tubercle-matter* must be established in the first instance through the digestive processes, as first described by the late Dr. Tweedy Todd under the name of *strumous dyspepsia*, and which has been since so fully described by Sir James Clark, Bennett, Hutchinson, and others.

The more closely these links of circumstantial evidence can be bound together the more intimate a pathological relationship will

be found to exist between the albuminous constituents of the food, the blood, and tubercle, and the saline constituents of the circulating fluid, the mal-assimilation of food, and the waste of the tissues, as connected with the development of the bad habit of body associated with scrofula.

Although it must be confessed that we do not fully understand the living processes by which all the molecular changes take place to which I have just adverted, yet there can be no doubt that in the seven statements enumerated we obtain some glimpses of a rational pathology, which may yet tend to explain the very complex *constitutional morbid state* which precedes and is associated with the growth of tubercle in scrofulous affections or with the specific inflammations and ulcerations of scrofula.

Healing of Local Lesions in Scrofula.—It is of the greatest importance to study how some of the most unmanageable and hopeless diseases will sometimes spontaneously become cured, and how the local lesions will heal. That scrofula sometimes tends to these results we have abundant testimony daily afforded in almost every *post-mortem* examination of those who die of *phthisis pulmonalis.* Laennec, Carswell, Clark, and Bennett have recorded their testimony on this interesting point; and the practical result of their observations shows that if the further growth of tubercle can be arrested, the masses already existing may silently retrograde, become absorbed, or diminish in size, and the part cicatrize, or it will remain latent as a cretaceous mass in the lung.

Symptoms of Scrofula, or of the Cachexia which Precedes and Accompanies the Growth of Tubercle.—Ever since scrofula has become more studied as a constitutional affection, it has been rendered more apparent that impairment of the digestive organs is the primary disorder of function which ushers in the cachexia, and that a certain form of dyspepsia is not only present in the hereditary strumous constitution, "but is capable of generating the bad habit of body, and of leading ultimately to the deposition of tubercle."

It was first observed by Dr. Wilson Philip "that there were some forms of indigestion which ended in phthisis;" and it was subsequently distinctly stated by Lepelletier that the causes of scrofulous disease were referable—(1.) To those agents which impair the assimilative action; (2.) To the elements of nutrition

being insufficient, by the influence of bad diet, impure air, deficient exercise of the general functions, and obstruction of the functions of excretion.

It was reserved, however, for the late Dr. Tweedy Todd, as already noticed, to show that in cases in which the strumous cachexia was present a particular form of dyspepsia prevailed, to which he gave the name of "strumous dyspepsia." Subsequently the views of Dr. T. Todd have been more or less fully accepted and developed by Sir James Clark, Bennett, Ancell, and others in this country; but the most precise and most recent exponent of them has been Mr. Jonathan Hutchinson, in two valuable papers in *The Medical Times and Gazette*, vol. x., 1855. Mr. Hutchinson, from statistical evidence, shows that the tuberculous cachexia is preceded by a *peculiar form of dyspepsia;* in other words, that there is a peculiar form of dyspepsia which has a natural tendency to end in phthisis; and that it is a form of dyspepsia not common to other conditions of the system—different, for instance, from that which precedes and attends gout, chlorosis, or cancer, although accurate observation is wanting on the exact symptoms of dyspepsia which are associated with these diseases.

The conclusions which have been arrived at by Mr. Hutchinson are as follow:—

1. In a very large majority of cases of established phthisis a condition of well-marked dyspepsia is present as a complication. Out of fifty-six cases it was absent in four, present mildly in twenty-one, moderately in twenty-two, and severely in nine.

2. Of the form of dyspepsia most common in established phthisis, the prominent symptoms relate to difficulty in the assimilation of fatty matters. The patient acquires a remarkable distaste for all fats, which occasionally extends itself to sugar and even to alcohol; he suffers much from "biliousness," heartburn, flatulence, and, above all, from acid eructations after taking food; everything he takes "rises acid," to use a common expression of such patients, but more particularly everything containing fat, oil, or sugar (*butyric* fermentation).

The *dislike for fat* was present in 71 *per cent.* of the cases of confirmed phthisis, and had existed through life in 48 *per cent.* It invariably produced what is commonly called "biliousness," and "rose acid" from the stomach. The fat of fresh meat was generally the first to disagree; then salted meats, such as bacon,

and lastly butter; but many could enjoy butter who could not touch any other kind of animal fat. Such an intense dislike to an important element of a mixed diet indicates a deficiency on the part of the patient to digest it. Coincident with the development of such symptoms *emaciation* usually becomes apparent, the adipose tissue of the body already existing being re-absorbed by the blood, to supply the respiratory element deficient in that fluid. The fat disappears from the subcutaneous tissue, hollows of the cheeks, orbits, and mammary glands, and other parts where it generally abounds in quantity, just as it disappears from the body of an animal during hybernation. The patient now gradually loses weight and becomes thinner. Other tissues of the body, such as the muscles, skin, and areolar tissue, subsequently begin to be used up for a similar purpose, till the patient is wasted to a living skeleton.

The *acid eructations* were present in 62 *per cent.* of the cases, and were a prominent symptom in 46 *per cent.*, small quantities of an extremely acid fluid being repeatedly brought up into the pharynx at various periods after taking food, and in bad cases these eructations were persistent throughout most of the day, and almost always attended by heartburn. *Sick headaches* and *biliousness* were very commonly present.

3. The majority of cases of *phthisis pulmonalis*, whether hereditary or otherwise, are *preceded* by a well-marked stage of dyspeptic symptoms. By this it is meant that symptoms referable to the digestive organs have preceded those connected with the lungs. Out of the fifty-two cases in which, as has been shown, dyspepsia was present, it had followed pectoral symptoms in nine, was developed nearly coincidently with them in ten, and preceded them in thirty-three.

4. The symptoms of the dyspepsia premonitory of phthisis are the same in character with those which complicate it when developed. The very earliest are alterations in the tastes, and the most constant of all is a disrelish for fat.

5. The subjects of phthisis have in a large number of cases had peculiarities of likes and dislikes for different articles of food even from very early life, and whilst seemingly in perfect health. Amongst those peculiarities the dislike of fat, often amounting to extreme aversion, ranks first. Thus it might be predicated of a family in which one child distinguishes itself from its brothers

and sisters by its refusal to eat fat, that it will, *cæteris paribus*, be more prone to become the subject of tuberculous disease in after-life than any of the others.

Besides the indications afforded by the functions of digestion, there is a peculiar modification of the whole organization, as regards structure, form, and the exercise of functions generally, which impresses distinctive characters on the scrofulous cachexia when it is of hereditary origin. Miller gives the following concise description of this organization :—

"The complexion is fair, and frequently beautiful, as well as the features. The form, though delicate, is often graceful. The skin is thin, of fine texture; and subcutaneous blue veins are numerous, shining very distinctly through the otherwise pearly-white integument. The pupils are usually spacious; and the eyeballs are not only large but prominent, the sclerotic showing a lustrous whiteness. The eyelashes are long and graceful—unless *ophthalmia tarsi* exist, as not unfrequently is the case; then the eyelashes are wanting, and their place is occupied by the swollen, red, unseemly margin of the lid.

"In the phlegmatic form the complexion is dark, the features disagreeable, the countenance and aspect altogether forbidding, the joints large, the general frame stinted in growth, or otherwise deformed from its fair proportions. The skin is thick and sallow; the eyes are dull, though usually both large and prominent; the general expression is heavy and listless; yet not unfrequently the intellectual powers are remarkably acute, as well as capable of much and sustained exertion. The upper lip is usually tumid, so are the *columna* and *alæ* of the nose, and the general character of the face is flabby; the belly inclines to protuberance; and the extremities of the fingers are flatly clubbed, instead of presenting the ordinary tapering form" (*Principles of Surgery*, p. 55).

The growth of the body is generally unsteady in its progress; very often it is slowly and imperfectly developed; in other cases it is unusually rapid, particularly towards puberty. The physical powers are generally feebly developed, and incapable of sustained exercise. The muscles of the limbs, though full, are soft, flabby, and weak, and have neither the form nor the firmness of health. The general circulation is feeble, the weak pulse and cold extremities indicating the debility. Digestion is feebly and imperfectly performed, the bowels being irregular, and more frequently slow in their action than the reverse.

The mucous membranes generally are very susceptible to dis-

ordered action. Discharges from the nose, ears, or eyes are not uncommon; the tonsils enlarge, and the air-passages inflame from the slightest causes. The insensible perspiration is defective, and is said to be unduly acid, and loaded with sebaceous matter; while, on the other hand, copious partial perspirations are common, particularly on the feet, where the odour is often fetid.

In children the impaired functions of the digestive organs are indicated by increased redness of the tongue, especially toward the extremity and along the margins. The anterior part is thickly spotted with small red points of a still brighter colour, the central portion being more or less furred, of a white or of a brown colour in the morning. Thirst prevails; the appetite is variable, more frequently craving than deficient, seldom natural; and the breath is fetid. The bowels are occasionally loose, and the evacuations are always unnatural, generally of a pale greyish colour, of the consistence and appearance of moist clay; and they are often mixed with mucus and partially digested food. While the urine is often turbid, and sometimes high coloured, it is also often abundant and pale. The skin is generally harsh and dry, or subject to cold perspirations, particularly the hands and feet, which are habitually cold; and copious partial night sweats are common. The sleep is seldom sound; the child is restless, talks in his sleep, or grinds his teeth (T. Todd, Clark).

Subsequently, when the disordered state has continued for some time, the internal fauces become full and red, and inflammatory sore throats are common, the tonsils often becoming permanently enlarged. The nostrils are generally dry, or thick mucus may be discharged in large quantity. Epistaxis occasionally occurs.

The nervous sensibility is sometimes greatly increased, and the intellectual functions are often performed with a preternatural degree of activity. So frequently is this observed that it has become a popular belief and saying regarding such a child "that it may be too wise to live long."

Inflammation in any tissue in a scrofulous subject generally assumes a slow chronic type, accompanied with little pain or heat; and suppurating parts heal very slowly.

When the scrofulous cachexia becomes fully developed into *phthisis pulmonalis*, the duration of the disease ranges from about nine months to two years; but in what are called "acute" cases of consumption it may terminate fatally in three or even

in two months, and occasionally in as short a period as three weeks, or even less.

Causes.—In describing the pathology and the symptoms of the scrofulous cachexia, the cause of the constitutional disorder has already been in some measure indicated.

The tendency to the formation of tubercle in scrofula is not equally great at all periods of life, nor in all parts of the body. Tubercle in the bronchial glands, the lungs, the cervical glands, the mesenteric glands, the spleen, the pleura, the liver, the small intestines, and the brain, is most common in infancy, childhood, and early adolescence. But the occurrence of tubercle, which forms so large a portion of the lesion in all scrofulous affections, although it has been found in the fœtus, and at every period of life up to eighty, yet it will be observed that tubercle, after the age of fifteen, is more frequently met with in the intestines, the mesenteric, cervical, and lumbar glands. Scrofulous disease is frequently developed during infancy; and "I have met with several cases of infants," writes Sir James Clark, "dying of consumption within the first year of life, in whom the lungs were not only extensively tuberculous, but contained large caverns, with all the characters of those found in the lungs of adults." After the second year of life, pathologists agree as to the universal prevalence of scrofulous disease. Age exercises a paramount influence on the generation of scrofula. It is peculiarly a disorder of childhood and youth (GUERSENT, LOMBARD, PAPAVOINE, ALISON, CLARK, BENNETT). Dr. Alison demonstrated that the mortality from scrofulous diseases in the children of the lower orders in Edinburgh and other large towns was so great that they died in the enormous proportion of forty-five or fifty to five and even three, as compared with the agricultural and upper classes. Tubercles prevail most through the third, fourth, fifth, and sixth years, when the annual growth does not exceed one-tenth of the child's weight, and the mortality declines to nearly one in a hundred. More than a fourth of those who die in the interval from birth to puberty are affected with scrofulous disease; yet the disease itself causes death in about one-sixth only of the cases (CLARK). The greatest number of deaths occur between the ages of twenty and thirty; the next in proportion between thirty and forty; the next between forty and fifty. The mortality is at its maximum about thirty, and from that age declines.

The broadest fact established regarding the exciting cause of scrofula is, that the domesticated animal is more liable to scrofulous disease than the same animal in a wild state. The stabled cow, the penned sheep, the tame rabbit, the monkey, the caged lion, tiger, or elephant, are almost invariably cut off by scrofulous affections—no doubt due to deficient ventilation and the abeyance of normal exercise of the pulmonary function.

Parents whose digestive organs are habitually disordered, who suffer from gout, the injurious influence of metallic and other poisons, such as *mercury, malaria, syphilis, chlorosis,* or *paludal anæmia, the debility of advanced age,* so that a cachectic state is induced, entail upon offspring begotten during such morbid states of the parent, to an extent still undetermined, but obvious and appreciable, a tendency to the scrofulous constitution, not necessarily to be expressed by the growth of tubercle in the lungs, but certainly and surely by various forms of dyspepsia and a precarious state of health.

There are many circumstances in the state of the parents' health, presumed, with justice, to influence the health of the children born under them. Among these may be mentioned a disordered state of the health of the mother, interfering with the state of the fœtus *in utero,* depressing passions, and generally an unhealthy mode of life. "In the present state of our knowledge," writes Sir James Clark, "it is not possible to determine the various circumstances in the health of the parent which may give rise to scrofulous growth in the child, much less to explain the development of scrofula. I rather allude to them as subjects deserving the investigation of the general pathologist and practical physician. There may be differences of opinion as to the particular condition of the parent which induces the tuberculous constitution in the offspring, and also as to the degree in which this constitution may exist in the child at birth."

Let the topics suggested in this quotation be diligently inquired into by those who have the opportunity; and let the initiative be followed up so ably set forth by Dr. Walshe in the model paper from which the previous statements have been quoted.

The scrofulous constitution has been observed to manifest itself in the child under the following circumstances:—

1. At birth tubercles may exist in one or more organs (Chaussoier, Oehler, Husson, Billiard).

2. The scrofulous cachexia, already defined and described, may rapidly show itself.

3. By the rapid occurrence of tubercles commencing very soon after birth, subsequent to the gradual appearance of symptoms of the scrofulous cachexia.

4. By a disposition to the various forms of dyspepsia, whose characters have been already noticed (page 207, *ante*).

Race has an influence in the production of phthisis. In this country the tendency of the Creole and Negro to phthisis is notorious. But it is notorious also that the Creole and the Negro, when removed beyond certain limits of the land of their nativity, become tuberculous in other lands besides Great Britain. In the West Indies some of the black races are by no means exempt from this disease, and the Creoles die of phthisis in large numbers in Martinique (Rufz, Nott, Morton). This is the more unlooked for, because as children they live almost in the open air, bathe daily, or still more frequently, and are singularly cleanly in their persons.

"Among the predisposing causes of phthisis," writes Laennec, "I know of none more certain than the *depressing passions*, especially when they are profound and long indulged; and this perhaps is the cause of the greater prevalence of this disease in larger towns, where bad habits and bad conduct are more common, and often the cause of those bitter regrets which neither time nor consolation can assuage." He adds, "I had under my own eyes for ten years a most striking example of the influence of melancholy in the production of phthisis. There existed in Paris for that space of time a nunnery of a new foundation, and which had not been able to obtain from the ecclesiastical authorities anything but a temporary tolerance on account of the severity of its rules. The alimentary regimen of the nuns, although extremely severe, was still not beyond the bounds of nature; but the spirit of the rules of the nunnery, directing the mind to the most terrible rather than to the consoling truths of religion, as well as compelling the inmates to resign themselves in everything to the will of the abbess, produced effects as sad as unexpected. These effects were the same in all. At the end of two months' sojourn in this house the *menses* became suppressed, and in a month or two afterwards symptoms of phthisis appeared. As the nuns had not been allowed to take the usual vows, I

entreated that they would leave the house; and all who followed this advice recovered. But during the ten years I was physician to this establishment the members were renewed twice or thrice, with the exception of the superior, the *tourière,* the sisters who had the care of the garden, of the kitchen, and of the infirmary, or of such as had more frequent intercourse with the city, and consequently greater distraction. The rest died of phthisis."

These circumstances now noticed—namely, hereditary predisposition, or the influence of parental cachexia generally, of various sources, especially syphilis, the influence of *race,* and of depressing passions—all co-operate, where they exist, in establishing the scrofulous cachexia; but the efficient cause seems to be "the impoverished nutrition resulting from *impure air,* and an *improper quantity, quality,* or *assimilation of food;* and so long as misery and poverty exist on the one hand, or dissipation and enervating luxuries on the other, so long will the causes be in operation which induce this terrible disease" (BENNETT).

It is, therefore, *the constitutional state* previous to the actual occurrence of local scrofulous affections like tubercle which it is of the utmost importance, if possible, to recognize; and the question has been proposed, "Whether or not a predisposition to scrofula can be anatomically or otherwise demonstrable?" There can be no doubt that an assemblage of phenomena, more or less well expressed and obvious, are characteristic of the scrofulous constitution. These phenomena are mainly due to impaired nutrition of the fundamental parts of the frame, and are associated with imperfect growth, especially of the skeleton, the nervous system, and the intestinal tract — imperfections capable of hereditary transmission to a remarkable extent. Of the structural characteristics of scrofulous persons, none are so significant as the weakness of cell-growth apparent in imperfections of the areolar tissue, as seen in the smooth, soft, delicate, blanched, and transparent skin. The nails are generally defective, elongated, and remarkably incurved. The mucous membranes are thin, pale, delicate, attenuated, and easily expanded. The debility of their function has been already fully noticed. The vascular system is thin, the vessels are transparent, more distensible, and less contractile than in the robust and healthy; and the visible tenuity of the vascular coats is sometimes rendered

GROWTH OF THE HUMAN BODY FROM EIGHTEEN TO THIRTY YEARS OF AGE, INDICATED BY WEIGHT AND HEIGHT: AVERAGES TAKEN FROM 100 OBSERVATIONS AND UPWARDS AT EACH AGE. RECORDS TAKEN FROM OBSERVATIONS UPON 4,800 CRIMINALS AT ALL AGES (*Statistical Society's Journal*, March, 1862, by J. W. Danson).

Age.	WEIGHT.										HEIGHT.									
	Average.		Maximum.		Minimum.		Maximum over Average.		Maximum under Average.		Maximum over Minimum.		Average.		Maximum.		Minimum.		Maximum over Average.	Minimum under Average.	Maximum over Minimum.
	Stones.	Pounds.	Stones.	Pounds.	Stones.	Pounds.	Stones.	Pounds.	Stones.	Pounds.	Stones.	Pounds.	Feet.	Inches.	Feet.	Inches.	Feet.	Inches.	Inches.	Inches.	Inches.
18	8	10·79	10	13	6	6	2	2·2	2	4·79	4	7	5	4·34	5	11	4	$10\frac{1}{2}$	6·66	5·84	$12\frac{1}{2}$
19	9	4·11	12	8	7	4	3	3·89	2	0·11	5	4	5	4·94	5	$11\frac{1}{2}$	4	11	6·56	5·94	$12\frac{1}{2}$
20	9	5·58	12	8	7	13	3	2·42	1	6·58	4	9	5	5·11	5	11	5	1	5·89	4·11	10
21	9	5·02	12	0	7	3	2	9·	2	2·	4	11	5	5·57	5	$11\frac{1}{4}$	5	$0\frac{1}{2}$	5·68	5·07	$10\frac{3}{4}$
22	9	12·41	13	2	7	0	3	2·59	2	12·41	6	1	5	6·17	6	1	5	$0\frac{1}{4}$	6·83	5·92	$12\frac{3}{4}$
23	10	2·95	12	12	7	12	2	9·05	2	4·95	5	0	5	6·17	6	1	4	11	6·83	7·17	14
24	10	2·	12	12	7	12	2	10·	2	4·	5	0	5	5·94	6	1	4	9	7·06	8·94	16
25	10	5·65	13	8	8	2	3	2·35	2	3·65	5	6	5	6·30	6	0	4	11	5·77	7·30	13
26	10	1·06	13	8	6	12	3	6·94	3	3·06	6	10	5	6·28	6	$1\frac{3}{4}$	4	9	7·07	8·78	$16\frac{1}{4}$
27	10	4·75	13	10	7	12	3	5·25	2	6·75	5	12	5	6·38	5	$11\frac{3}{4}$	5	1	5·37	5·38	$10\frac{3}{4}$
28	10	2·62	13	2	7	7	2	13·2	2	9·62	5	9	5	6·65	6	1	5	1	6·35	5·65	12
29	10	5·53	13	12	8	4	3	6·47	2	1·53	5	8	5	7·02	6	$0\frac{1}{2}$	5	$1\frac{1}{4}$	5·48	5·52	$11\frac{1}{4}$
30	10	1·55	14	1	8	1	3	13·45	2	0·55	6	0	5	6·36	6	1	5	$0\frac{3}{4}$	6·64	5·51	$12\frac{1}{4}$

apparent in the tendency to hæmorrhages from slight causes, The veins are conspicuous, and appear to be more numerous under the skin. The bones are imperfectly grown; and there is often a greater want of symmetry than usual in the skeleton. The weight of the man is light compared with his size and his age; and on these points in healthy men there ought to be a due concurrence. So important is the information capable of being derived from accurate observations in this direction, that the preceding and following tables are given for the purposes of comparison:—

HEIGHT, AND CIRCUMFERENCE OF CHEST OF 1,270 YOUNG PERSONS, RECORDED BY DR. HARRISON, OF PRESTON (*Edin. Med. and Surg. Journal*, 1835, p. 425).

Age.	Number Examined.	HEIGHT.			CIRCUMFERENCE.		
		Average.	Tallest.	Lowest.	Average.	Great.	Small.
		Ft. In.	Ft. In.	Ft. In.	Inches.	Inches.	Inches.
11-12	210	4 2¾	4 11	3 10½	25½	30	22
12-13	203	4 5	5 0	3 11	26	29	21
13-14	192	4 6½	5 3	4 0	26	32	23
14-15	197	4 7	5 3	4 0	26½	32	21
15-16	186	4 10	5 6	4 1	27½	32	23
16-17	131	5 0¾	5 7	4 4	28	34	24
17-18	151	5 0¾	5 7	4 3	27½	34	23

Growth is thus most marked between the ages of fourteen and sixteen years. Its rate is as much as three inches during that time; and about ten inches from the age of eleven to eighteen; and it goes on to be marked between eighteen and twenty-five years of age, when it is about two inches.

There are also ample physiological reasons of the most cogent kind which clearly show that great care is necessary in the physical training of young persons.* The main reasons are to be found in the co-relations which obtain amongst the follow-

* I. Compare the average height of *full-grown* men at twenty-five years of age, as given by the following observers:—

Quetelet,	5 feet 5·27 inches	= 65·27 inches.	Average, 66·8.
Danson,	5 ,, 6·30 ,,	= 66·30 ,,	
Boyd,	5 ,, 7· ,,	= 67· ,,	
Liharzik,	5 ,, 8·89 ,,	= 68·8 ,,	

II. The average height of the *growing lad* at eighteen years of age:—

Boyd,	5 feet 0·5 inches	= 60·5 inches.	Average, 63·003.
Liharzik,	5 ,, 4·17 ,,	= 64·17 ,,	
Danson,	5 ,, 4·34 ,,	= 64·34 ,,	

ing elements, namely,—(1.) Age; (2.) Weight; (3.) Stature; (4.) Development and growth of the skeleton; (5.) The vital capacity of the chest; (6.) The growth of the muscles in relation to the bones; and the progressive increase of muscular force with advance of years.

There are individual peculiarities connected with the skeleton which at once ought to excite suspicion and suggest careful training. These are,—(1.) Narrowness of the thorax, especially at the expansion of the false ribs—a condition, when combined with functional incapacity or inefficiency in the acts of respiration of most characteristic significance. The vital capacity of the lungs, as determined by (Hutchinson's) spirometer, compared with age, weight, height, ought to be observed and recorded in all physical examinations. Hutchinson's observations show that men from five to six feet high have a vital capacity of lung ranging from 174 to 262 cubic inches, in an ascending scale according to height and age; and whenever the quantity of air is 16 *per cent.* deficient, there is reason to suspect some local affection of the chest. Dr. Graham Balfour has subsequently followed up these investigations with the spirometer. He has especially examined how far a capacity *under* the average may be taken as an indication either of a tendency to pulmonary disease or of a feeble constitution, rendering the man liable to a higher rate of mortality than that to which men of or above the average are subject. He found that the loss to the service by consumption was much greater among the men having a "*vital capacity*" *under the average* than amongst men of *average* capacity or *above* it; and although the proportion of deaths did not differ materially amongst those three classes, yet the invaliding was *four times as high* among men *under the average* as among the others. A "vital capacity" *below the average* may therefore be considered as indicating a generally feeble organization, less capable of resisting the deteriorating influences to which a soldier is exposed, ("Contributions to the Study of Spirometry," *Med.-Chir. Transactions*, vol. xliii.)

Such functional incapacity is further indicated by the "breathing being shorter," with less "breath motion." The *Ex*piration is quick and forcible; and there is a minimum quantity of air taken in by ordinary *In*spiration. Such lessened respiration tends of itself to induce accumulation of mucus in the air-cells,

and thereby to set up inflammation. Everything which tends to impede or to interrupt or obstruct the regular, complete, and continuous performance of the respiratory acts has a most prejudicial effect upon the lungs (especially of "growing lads"), favouring the accumulation of growing material in the air-cells, which may eventually degenerate and form a cheesy mass in all respects resembling tubercle. Life not only depends on breathing, but the energy and the vigour of life are in a great measure ruled by the capacity and the free play of the breathing organs (SIBSON, 1844). Thus Dr. Walshe has very justly directed attention to the prevalence of anæmia amongst female servants in London, who are obliged to go up numerous and long flights of stairs very often in their daily labours; and is of opinion that the suspended inspiratory acts have much to do with the peculiar state of the blood that ensues ("Clinical Lectures," *Lancet*, 1849). It is very important to remember, in regard to training animals and young persons, that they have much more extent and range of lung than are required in the quiet every-day pursuits of life. Less lung is used when the animal lies down or sleeps, or is depressed; and, on the contrary, walking, running, wrestling, the force of the passions, each or all of them bring the greatest amount of lung into action or use. In short, the amount of lung in use is an ever-varying quantity; and just as much lung *may come to be used as* A HABIT as the listlessness or vigour of the moment requires. There is every range, every variety, till the top of the wind, the top of the speed (the full vital capacity) is attained (SIBSON). Practically, therefore, the more fully the lungs are judiciously used, the more is their capacity nursed; and conversely, the less they are used and expanded, the more useless are they likely to become, if not absolutely diseased. Under a judicious system of training, an undeveloped man, even although he may be feeble, narrow-chested, and sickly, may yet become active, full-chested, and healthy. We have numerous examples of this among the boys in our training ships for seamen. The over-fed, short-winded pugilist, rower, or cricketer, may in a few weeks be changed, by training alone, to the firm-fleshed, clear-skinned, long-winded winner of the boxing fight, the foot race, or the rowing match.

It is this want of use that probably renders the apices of the lungs more liable to the growth of tubercle in them than in any

other part of their substance. It is a portion of the lungs which has less play or expansion than any other portion, and is apt to be bound down by the surrounding parts. The apices are, therefore, the parts most likely to remain in a quiescent state of non-expansion, especially when acts of respiration are inadequately performed, either owing to the constrained position of the body in certain trades, or from habitual stooping of the body from listlessness of habit or want of vigour in the system. This quiescent state of the air-cells is favourable to the growth of tubercle; and thus the apices of the lungs are the most common seat of tuberculous growths (Reviewer in *Medical Mirror*, vol. i., p. 638). The effects of want of exercise and of impure air are thus most potent agencies in causing phthisis. "The much greater prevalence of phthisis in most of the European armies (French, Prussian, Russian, Belgian, and English) can scarcely be accounted for in any other way than by supposing the vitiated atmosphere of the barrack-room to be in fault." In all the places where phthisis has prevailed, in the most varied stations of the army, and in the most beautiful climates, the only common condition was the vitiated atmosphere which our barrack system everywhere produced; "and, as if to clench the argument, there has been of late years a most decided decline in phthisical cases in these stations, while the only circumstance which has notably changed in the time has been the condition of the air" (PARKES, l. c., p. 91). Indeed, the air is rendered so impure by respiration, that while an atmosphere so vitiated has a most injurious effect upon the health, contamination of the air has been so great, where lung diseases abound, as to give rise to the idea that phthisis appeared to be propagated by contagion (BRYSON, PARKES).

It is therefore within the power of the medical officer to direct the physical training of young persons so that the apparently sickly and the short-winded may in time be developed into the wiry and active young man, long in wind, sound in body, and lithe of limb—a result which, however, can only be attained by judicious feeding, careful exercise throughout the development of the body, and by the gradual nursing of the breathing powers. The opposite of this is seen in the breaking down of recruits at a very early period of service in the Army—within the third year—a result likely to be greatly obviated by the gymnasia which

are now being introduced by Government for the physical training of recruits before and after they are instructed in drill.

The Austrian runners are another class who are instances of breaking down by over-exertion in running at ages unsuited for their strength. They seldom live above three or four years, and gradually die of consumption (*Remains of Mrs. Trench*, p. 72).

In all physical training the condition of the heart must be considered not less than the lungs, seeing that its movements respond to the movements of the chest and the lungs. They are members of one great system; and in nursing one we nurse the other; for by giving tone and health to one we must give tone and strength to the other (SIBSON). If, on the contrary, the development and gradual training of the lungs are not successful, the lesions which become developed are of a peculiar character, and are apt to be thought very lightly of; because, in the first instance, they are so little capable of appreciation by a single observation; and, secondly, because the lesions are insidious, and take some time before they reach a stage to be apparent. Frequent observations extended over a considerable interval of time, and necessary to appreciate the wasting of delicate tissues which sets in, and which progresses so insidiously, and creeps on almost imperceptibly, but with a result so sure "that day by day and grain by grain the mortal part wastes and dies away." It is this progressive atrophy which it is so important to detect. Time is necessary to do this, and some certain mode of detecting the gradual decay. For this reason it is absolutely necessary to have the means of weighing men, and so to determine the ratio of the weight of the person to his age, to his height, and to his respiratory and other functions. These data are absolutely necessary to be known and recognized before any conclusions can be arrived at as to those healthy or normal physiological states with which weight has to do. It may, indeed, be stated generally that every organ and function has a physiological relation to weight and age; and, as a general rule, weight increases with the height and age, and there are physiological limits beyond which the range may not extend.*

Loss of weight is therefore *exceedingly significant*, if PROGRESSIVE, *as indicating a persistent atrophy*—the *grain* by *grain*

* Henry Pooley & Co., 89 Fleet Street, E.C., supply suitable weighing machines at a cost of £3, 15s., and upwards.

decay which is frequently the earliest appreciable sign of disease.

General Treatment of the Scrofulous Cachexia.—From what has been already stated in illustration of the pathology of this malady, it is to be observed that the general treatment now in most repute is founded on the doctrines—(1.) That scrofulous local lesions will heal of themselves if the nutrition of the system can be maintained and the continuous growth of tubercle arrested; (2.) That the periods of frequent temporary arrest of all the general and local symptoms of disease ought to be diligently taken advantage of to improve and preserve health by hygienic means; (3.) That the efforts of the practitioner should be directed to the digestive rather than to the pulmonary system; (4.) That the kind of morbid nutrition in the body generally, and altered morphological change in the tissues of the organ where the deposit takes place, appear to be chiefly due to excess of albuminous and deficiency of fatty elements in the chyle.

The treatment, therefore, to be pursued must be essentially reparative of the waste of tissue generally; corrective of what has been unfit in the individual diet and mode of life; and, lastly, supplementary of the elements of nutrition which have been deficient.

During the past *thirty* years in Germany, and *twenty-three* years in this country, the treatment of scrofulous affections has gradually but steadily become more and more firmly based on these pathological doctrines, which Dr. Bennett, of Edinburgh, was mainly instrumental in first elucidating, and in earnestly recommending to the notice of the profession generally in this country. The view here taken regarding the nature of scrofula leads to the belief that—(1.) The blood is impoverized through the preliminary dyspepsia which precedes the growth of tubercle; (2.) That in *pulmonary phthisis* the growth of tubercle results from the exudation of lymph and of new growth which is consolidated primarily in the air-vesicles; (3.) That the successive formation and softening of these tubercles lead to ulcerations of the pulmonary and other tissues, and promotes wasting of the body generally.

It has been now fully shown, especially by the observations of Dr. Bennett, in the first instance, confirmed by the extensive experience of the physicians at the Brompton Hospital for Con-

sumption in London, that such treatment as is directed to remove the mal-assimilation of food frequently checks the tendency to the repeated occurrence of tubercles, while those which previously existed remain harmless; that general symptoms and physical signs may disappear completely; and that even extensive excavations in the pulmonary tissue may heal up and cicatrize. According to the testimony of Dr. Wood, of Pennsylvania, the fatal results have not only been postponed, but the death-rate from phthisis has diminished in the principal cities of the United States since such principles of treatment have been adopted.

The indications of general treatment are therefore—

First, *To improve the faulty nutrition, which is the cause of the scrofulous cachexia, and of the exudations assuming the characters of tubercle.*

Second, *To subdue the fever which attends the growth and changes going on in the tubercle-nodules, and to favour the absorption either of the entire exudation, or of such portions of it, that what remains may undergo such changes as are consistent with its future harmless existence in the organs or other parts where it may have grown.*

Third, *To prevent the recurrence of fresh exudation by careful attention to hygienic regulations, especially during the intervals of apparent return to health.*

To fulfil the first of these indications it is of all things important that fatty matter be assimilated in large quantities, and it appears that such are most readily absorbed and assimilated when in the fluid condition. The substance of all others found most beneficial has been cod-liver oil. At the Brompton Hospital more than 600 gallons of this oil are used annually. There, on a great scale, its merits have been tested and compared with the effect of treatment conducted on general principles, and irrespective of its use. The result has been to confirm, in the estimation of the medical profession, the great value of this remedy in the treatment of phthisis, when appropriately administered, and combined with the use of such other measures as any special circumstances in the individual patient may require (Thompson). The general opinion of the profession with regard to cod-liver oil may be summed up in the statement originally made by Dr. Bennett, —namely, that "it rapidly restores the exhausted powers of the patient, improves the nutritive functions generally, and stops or

diminishes the emaciation. The night perspirations subside, the cough is quieted, and the expectoration is diminished after the oil has been used for a few weeks. A very constant and well-marked favourable change under its use is to be noticed in the diminution of the pulse, which gradually but steadily has been observed to come down at the rate of five or six beats weekly; and during the same period the weight of the body has been known steadily to increase at the rate of half a pound to a pound. In females it is a significant and highly favourable symptom when the catamenia return after the oil has been used for some time. The usual dose adopted by the late Dr. Thompson, at the Brompton Hospital, is *one* or *two tea-spoonful twice a day* at first, and gradually increasing the quantity to *half an ounce three times a day.* Dr. Bennett recommends somewhat larger doses—namely, for an adult, *a table-spoonful three times a day,* which may often be increased to *four* or *even six* with advantage. When the stomach is irritable, however, *a tea* or *a dessert spoonful is enough to commence with.* It appears from the observations of Dr. Thompson that no additional advantage is obtained by pushing the oil beyond the limits of the doses adopted by him at the Brompton Hospital, from the fact that where its use has most obviously increased the weight of the body, to the extent in one instance of a pound per week for twenty-one weeks, only three pints had been taken during that time. The kind of oil used, as far as coarseness or fineness is concerned, seems not to affect the beneficial result in any material degree. Some patients even prefer the coarse to the fine oil. The experience of some is, moreover, favourable to combining the oil with *liquor potassæ* as an emulsion; and as it appears that undue acidity prevails as well in the stomach as in the intestinal canal, the addition of the alkali ought, on theoretical grounds, to be advantageous.

It seems also that, when cod-liver oil was first used as a medicine, more than fifty years ago, in the treatment of rheumatism, it was then ordinarily combined with an alkali. It may be taken, however, unmixed, or it may be floated on milk, or nitro-muriatic acid mixtures, or on lemonade, soda-water, lemon juice, or on a saline draught during effervescence, when such combinations are suited to the patient. Creosote has been recommended to be added, as it is said to render the stomach more tolerant of

the remedy. The following formula, quoted from Dr. Thompson's *Clinical Lectures on Pulmonary Consumption*, yields a palatable mixture, which ought to be combined as an emulsion:—

"An ounce and a half of cod-liver oil, four drops of creosote, two drachms of compound tragacanth powder, and four ounces and a half of aniseed water. Of this mixture an ounce may be taken thrice daily."

The more direct and immediate action of cod-liver oil upon the blood has been attempted to be ascertained by Simon, Snow, and Thompson. They record an increase of blood-corpuscles and a diminution of fibrin under its use; and from the researches that have been made in animal chemistry regarding the blood in phthisis, a deficient proportion of blood-corpuscles is observed to be a most constant peculiarity. But phthisis is not the only disease in which this occurs, as shown by the following table (SIMON):—

AVERAGE PROPORTION OF SOME CONSTITUENTS OF THE BLOOD.

	Albumen.	Corpuscles.		Albumen.	Corpuscles.
In Health,	76	130	In Diabetes,	105	80
In Pneumonia,	80	122	In Bright's Disease,	103	50
In Phthisis,	100	78	In Chlorosis,	72	56
In Rheumatism,	100	74	In Carcinoma,	45	55

Rheumatism and diabetes present the greatest similarity in these states of the blood to phthisis; and they are diseases for which cod-liver oil has been used with advantage.

Cod-liver oil, therefore, is indicated, where it can be taken, in all those diseases in which the blood-corpuscles are deficient, where nutrition is impaired, and where fat is not readily assimilated.

Besides cod-liver oil, other animal fats and oils, where they can be taken and assimilated, are sure to be followed with benefit. Hence milk rich in fatty matter, such as asses' milk, and milk drawn from cows at a short interval after the greater part of their milk has been withdrawn, and which is known in Scotland as the "afterings," are found to be followed by improvement where they are persevered in and are assimilated. So also has it been with cream and butter. Dr. Bennett instances the partial success occasionally of caviar, bacon, pork, mutton chops, and the marrow of the bones of oxen; while Dr. Thompson instances the good effects he has obtained from the use of oil obtained from the foot of the young heifer (neat's-foot oil). The administration

of any of these remedies is quite consistent with doctrines now taught regarding the pathology of tuberculosis, and it is useful to know their individual value, in order that in particular cases one may fall back upon their use where a change may be desirable.

It has been considered that some of the good effects of cod-liver oil may be due to the biliary elements with which it has been incorporated. This view is not supported by the experiment of adding ox-gall to other animal oils not derived from livers, as no beneficial results have been observed to follow. But as the active principle of the gastric juice has been now successfully isolated by chemistry, and has been successfully used to aid the digestion of food in the stomach, might not some principle be obtained from the liver which might aid the assimilation of fatty substances when mixed with the intestinal juices?

In fulfilment of the second indication mentioned (p. 222), the propriety of abstracting blood has been much discussed.

It has been already seen that febrile symptoms of a very severe kind sometimes attend the exudation and consolidation of tubercle. It is also a more or less frequent clinical observation that pneumonia, bronchitis, and pleuritis, in acute or chronic forms, are intercurrent attendants on the deposit and future changes of tubercles in the lungs. "Hence," as Dr. Bennett justly observes, "there are all kinds of intermediate changes between the simple and tubercular exudations constantly going on in the progress of a case of pulmonary tuberculosis. The phenomena of phthisis, pneumonia, pleurisy, and bronchitis, in their acute or chronic forms, may appear together, and be inextricably mingled, or they may succeed each other at intervals." Thus tuberculosis, both as a constitutional and as a local disease, is scarcely ever free from exacerbations, the various local and constitutional states acting and re-acting on each other. While, therefore, on the one hand, the system requires an increased and well-directed supply of nutritive materials; on the other hand, there are constitutional states of excitement, depending on local irritation, which require to be subdued, and even demand antiphlogistic treatment. Whatever theoretical view may be taken as to how the exudation may most readily be absorbed, all physicians are now at one as to the propriety of preserving the general strength, of effecting elimination of effete material, and

of meeting antiphlogistic indications rather by diaphoretics, diuretics, emetics, and purgatives, than by abstracting any considerable amount of blood, either at once or at repeated intervals. In fact, it is now observed that the administration of appropriate diet, and abstinence from lowering remedies, with cod-liver oil, while they correct the general nutrition, may be so regulated as to subdue the constitutional irritation by a perseverance in their use for a period of not less than four or six weeks. Moderate general bleedings in acute phthisis, as well as local bleedings during the exacerbations of chronic phthisis, undoubtedly confer a temporary relief in the diminution of local pain and general febrile re-action, and allow a more free respiration to be performed, if respiration should be impeded by congestion of the lungs. Dr. Bennett, however, is opposed to bleeding. His object is simply to favour excretion by means of antimonials; and, on subduing the re-action by their means, he again proceeds with the nutritive mode of treatment to fulfil the first indication. Nevertheless, it cannot be doubted that the condition of some cases demands blood-letting; but, as Sir James Clark observes, "The employment of general blood-letting in consumption requires great judgment and circumspection. The more general error is the abstraction of too great a quantity of blood at a time—treating the disease as if it were a purely inflammatory one, and forgetting that the inflammatory symptoms are merely consecutive upon tubercles, and that the constitution of the consumptive patient is little capable of replacing the blood too lavishly drawn." Simply to remove or diminish congestion, the condition of the patient and nature of his constitution being considered, "blood may be abstracted," he continues, "with advantage at any stage of consumption when the symptoms require it." The experience of Dr. Wood leads him to teach similar doctrines. Topical counter-irritants furnish the best means of subduing constitutional irritation in chronic forms of the disease. These may be in the form of setons, issues, succession of blisters, tartar emetic ointment, or croton oil rubbed on the chest in any of its regions. Amongst these the frequent use of dry cupping ought not to be omitted.

In fulfilling the third indication, the real power of the science of medicine may be demonstrated. It is by well-directed hygienic measures, successfully and efficiently carried out, that the real strength of the physician may be put forth to prevent

the recurrence of fresh exudation; and his hygienic exertions towards the patient are to be redoubled during the temporary intervals of apparent return to health. It is now almost an axiomatic truth, that of all things which deteriorate the constitution on the one hand, and influence pulmonary congestion on the other, none are so detrimental as impure and deficient air, together with frequent variations of temperature, and changes from sudden heat to chilling cold. These latter vicissitudes may be considered characteristic of the physical climate of Great Britain and Ireland. "The conditions of preventive treatment which have seemed most useful are nutritious food and proportionate great exercise in the free and open air. So important has this last condition proved to be, that it would appear that even considerable exposure to the weather is better than keeping phthisical patients in close rooms, provided there be no bronchitis or tendency to pneumonia or pleurisy" (PARKES, l. c., p. 445).

Tonic treatment consists essentially in the adoption of those means which promote or stimulate the healthy nutrition of the body. Its elements exist in fresh air, abundant exercise, sufficient repose, and judicious diet. A hygienic code applicable to the tuberculous cachexia has been recently laid down by Dr. Richardson, in the second volume of the *Sanitary Review*, and very recently in a special work *On the Hygienic Treatment of Pulmonary Consumption*. It is derived from these elements of tonic treatment; and as it puts well-known truths, too little appreciated, in a formal and more important aspect than is wont, its precepts are here quoted.

I. *A supply of pure and fresh air for respiration is constantly required by the tuberculous patient.*

As it is known that if *one per cent.* of carbonic acid exists in a room, the air is unfit for a healthy person, it is therefore much more so for a consumptive one. The temperature of a room ought to be equally maintained at from 55° to 56° Fahr., ventilation and heating being effected by open fire-places. A single room ought not to perform the two offices of a bed-room and a sitting-room. The sleeping-room ought not to afford less than 1,000 feet of space; and if larger, so much the more healthful will it be. In connection with these statements, while it is objected, for obvious reasons, with much justice, to the treatment of tuberculous patients in special hospitals, there is much on

the other hand that might be improved in all our hospitals, with reference to the arrangement of the patients, to secure to them fresher air than they generally obtain. "Constant though imperceptible movement of the air is the point to be attended to"—*i. e.*, thorough ventilation. All who are able to be out of bed ought to have their meals in a common room, which is not used for any other purpose, and is apart from the wards or dormitories.

II. *Active exercise in the open air is imperatively demanded by the tuberculous patient.*

In the words of Dr. Jackson, "He must be made to feel that the *risk is in staying in the house*, and not in going out of it." But the skin must be perfectly protected, and while a chill, or inclement weather, is to be avoided, the patient must go out in all seasons, without being too fastidious about the weather, walking exercise being persevered in as much as possible, "The best climates for phthisis are perhaps not necessarily the equable ones, but those which permit the greatest number of hours to be passed out of the house" (PARKES). Next to diet, exercise in the open air is, of all things, the most important: it should be carried as far as the vigour of the patient will permit. It should not be done rashly, but boldly; and, if possible, the patient ought to have faith in it, for without this he is not likely to pursue it so far as he can, and then he will not derive from it all the benefit which it can afford (JACKSON).

III. *It is important to secure for the patient a uniform, sheltered, temperate, and mild climate to live in, with a temperature about* 60°, *and a range of not more than* 10° *or* 15°; *where also the soil is dry and the drinking-water pure and not hard.*

The classic work of reference on this topic is that by Sir James Clark. If it is possible to give a practical abstract of his extensive and valuable experience, it may be done somewhat as follows:—

1. After the functions of the digestive organs and skin have been re-established in improved action, the patient who labours under a tuberculous cachexia may derive benefit by a residence in a mild or temperate climate (such as has been defined), conforming to all the hygienic and medicinal treatment already mentioned.

2. When symptoms, however slight, indicate that tuberculous deposit has located itself in the lung, removal to a mild climate, especially if effected by a sea voyage, under favourable circum-

stances, may still be useful as a means of improving general health, of lessening the chance of intercurrent inflammatory affections of the pulmonary organs, and even of arresting the further progress of the disease. The nausea, squeamishness, or even sickness, which with some are always more or less associated with a sea voyage, are beneficial to cases of incipient tuberculosis. The effects of such nausea tend to increase the natural secretion and elimination from the pulmonary mucous membrane; so that minute portions of tubercular exudation, commencing to consolidate in the air-vesicles, are effectually, gradually, and gently passed out with the motion of the pulmonary mucus in the expectoration. The sensation of nausea tends to subdue any local vascular irritation; and the unceasing motion of a sailing vessel tends to keep up a constant exercise which is advantageous to the patient.

3. When extensive tuberculous disease exists in the lungs, little benefit is to be expected from a change of climate; and a long journey will most certainly increase the sufferings of the patient, and hurry on a fatal termination.

4. There are cases, however, of chronic consumption which may derive benefit from residence in a mild climate,—namely, cases in which the deposit is limited to a small portion of the lungs, and little systemic irritation prevails; or in cases in which the disease has ceased to extend in the lungs, but where a long time is required to complete repair.

IV. *The dress of the scrofulous patient ought to be of such a kind as to equalize and retain the temperature of the body.*

Under this topic waterproof coats, boots, and shoes are to be condemned. Flannel ought invariably to be worn next the skin in all seasons; and in winter a chamois leather vest may be required over the flannel.

V. *The hours of rest should extend from sunset to sunrise.*

VI. *Indoor or sedentary occupation must be suspended; but outdoor employment in the fresh air, even in the midst of snow, has been and may be advantageous.*

VII. *Cleanliness of body is a special point to be attended to in the hygienic treatment of tuberculosis.*

VIII. *Marriage of consumptive females, for the sake of arresting the disease by pregnancy, is morally wrong and physically mischievous.*

IX. *The medicinal treatment must be adapted to the site of the local deposits and the general nature of the particular case.*

Medicine is utterly powerless and useless unless the hygienic means now insisted upon are carried out to the uttermost.

RICKETS.

LATIN EQ., *Rachitis;* FRENCH EQ., *Rachitisme;* GERMAN EQ., *Rhachitis* —Syn., *Englische Krankheit;* ITALIAN EQ., *Rachitide.*

Definition.—*A constitutional disease of early childhood, characterized by an unhealthy state of the system, which precedes for several weeks or months a peculiar lesion of the bones, manifested by curvature of the shafts of long bones and thickening of their cancellous extremities. Some of the solid visceral organs exhibit also peculiar lesions. The growth of the bones is characterized by irregularity, by non-solidification of their growing layers, and by the progressive formation of medullary cavities in the old, thus rendering the bony laminæ thin and brittle* (VIRCHOW). *In the solid visceral organs, such as the spleen and liver, there is generally albuminoid (amyloid?) degeneration.*

Symptoms.—The earliest recognition of the cachexia associated with rickets is rarely apparent before the fourth month of infant life; and usually between the fourth and twelfth months. It does not in general declare itself until the child first begins his attempts to walk, or until he shows suffering during the first dentition; and at first the progress of the disease is so very slow as almost to be imperceptible. The number of cases happening in the first or second years of life very greatly exceeds that of other periods; and there is a period of at least six months during which a marked series of deranged actions succeed each other, and which eventually culminate in the condition known as *rickets.* Many of the phenomena of these deranged actions are common to other diseases; but some are characteristic, and when they occur in sequence are sufficient indications of the specific characters of rickets. The symptoms may be arranged into four classes:—(1.) Those which are common to many diseases—symptoms which might arise from deranged digestion, from improper food, or from tuberculosis, and which are often referred to the "irritation of teething;" or to the so-called "infantile

remittent fever." These phenomena always denote the precursory or incubative stage of rickets; (2.) Those which at once mark the nature of the disease, render its diagnosis easy, and which enable us to predict that the bone affection will show itself; (3.) The stage of characteristic deformity; (4.) Phenomena of favourable or of unfavourable import, inasmuch as they may characterize a period of restoration to health, of irremediable atrophy of the body, or of approaching dissolution.

During the precursory or incubative period, the most ordinary symptoms of impaired general health are those which indicate gastro-intestinal irritation. The bowels are irregular in their action; sometimes confined, but more commonly there is diarrhœa, with tumidity or enlargement of the abdomen. The stools may be of a dirty brown or leaden colour, and of a most offensive odour. In some respects this odour is peculiar in its resemblance to rotten or half-decayed meat. Appetite is feeble, or entirely lost, and digestion is difficult. The child becomes dull and languid; sad, or peevish; febrile irritation prevails; the skin is hot; and the temper irritable. Although drowsy, it sleeps but little. It is thirsty, and will drink large quantities of water. If it has begun to walk, it is "taken off its legs." It lies about, and is unwilling to play, or to be amused, or to indulge in any kind of action. It prefers to sit or to lie; and it appears to be feeble or indolent, and is unable to use exertion of any kind. The transition from health to these phenomena is always gradual and slow; but there are at least three sets of phenomena which, according to Dr. Jenner, being superadded to these, are characteristic of the approach of rickets. These symptoms, therefore, stand by themselves in the second class as pathognomonic of this affection.

(*a.*) The most remarkable is *profuse perspiration of the head, or of the head and neck,* and upper part of the chest. It arrests the mother's attention, and she seeks medical aid. She will tell the physician that the perspiration stands in large drops on the child's forehead—that it runs in streams down the face; and it is especially when the child sleeps that such copious perspirations of the head occur; but they are not unfrequent when the child is at the breast, or even when only resting its head on the mother's arms. A little increased exertion, or a little increased temperature, may induce such excessive perspiration. Such perspirations are

extremely weakening and colliquative during sleep; and when they occur the superficial veins of the scalp are generally large and full; the jugular veins are much dilated, and sometimes the carotid arteries may be felt strong and pulsating (COPLAND, JENNER).

(*b.*) Another characteristic feature of the disease is seen in the desire and in the efforts of the little patient to be cool, particularly at night. The child kicks the bedclothes off, or throws its naked legs on to the counterpane; and this even in cold weather.

(*c.*) There is also, thirdly, general tenderness. The child cannot be moved without its uttering a cry: pressure on any part of its body is followed by evidence of suffering. It ceases to play and to move, but lies with outstretched limbs as quietly as possible, for all movement produces pain; and it will cry at the approach of any one who has been accustomed to move it in play.

As the disease progresses the child becomes staid and steady in appearance. It assumes a pensive, aged, and languid aspect. Its face grows broad and square; and when placed on the mother's arms, it sits (as she says) "all of a heap." The spine bends, and the muscles are too weak to keep the spine erect. Its head thus seems to sink between its shoulders, and its face appears turned a little upwards. Before the general cachexia has lasted long, the bone deformity begins to attract attention; and usually the lesion of the bones is out of all proportion in severity to the enlargement of the ends of the long bones; and the younger the child, the softer usually are the bones. The consequences of the bone disease thus become superadded to the general cachexia; and as the disease progresses, the muscles lose their power and begin to waste. The child cannot support itself; and if it has commenced to walk before it becomes the subject of extreme rickets, it loses its power of walking. Intellect is invariably deficient. The teeth are retarded in their development, and they fall from their sockets early. The back, arms, and sides of the face are often covered with downy hair. In short, as Dr. Jenner observes, "the general aspect of the ricketty child is so peculiar that when the crooked limbs, the large joints, and the deformed thorax are concealed, you may even detect its ailment at a glance. Its square face, its prominent forehead, its want of colour, its large staring and yet mild eyes, its placid expression, and its want of power to support itself like other children of its age, in its mother's arm, all conspire to form a picture which has no like in

the gallery of sick children," (*Med. Times*, l. c.) *Laryngismus stridulus* is a frequent result of rickets.

Treatment.—Ventilation of the room in which the child lives is of first importance. Milk diluted with lime water (about a fourth-part), and a tea-spoonful or two of cream added, is the best of food. Sugar ought not to be added to the milk. Liebig's food for children and Parrish's chemical food are both valuable agents in the dietary. About once a week a dose of rhubarb, soda, and calumba, in equal parts, should be given, followed next day by a tea-spoonful or more of castor oil. Prepared chalk and soda may also be given twice or thrice a day. When the febrile disturbance is subdued, the child should live as much as possible in the open air. *Vinum ferri* ought then to be given, or small doses of the *syrup of the phosphates of iron, quinine, and strychnia*, along with the food, or just before meals. Cod-liver oil is of essential service; but the stools ought to be examined daily, and if any of the oil passes by stool its dose ought to be diminished, or its administration suspended for a time. (For more details on *Rickets* and its treatment, consult the admirable lectures of Dr. Jenner, in *The Medical Times* of 1860, vol. i.)

CHAPTER V.

THE THEORY OF *SPECIFIC* DISEASES, COMPREHENDING THE SO-CALLED *ZYMOTIC* AND *CONSTITUTIONAL* DISEASES.

THE classes of diseases which have been now considered—namely, the so-called ZYMOTIC and the CONSTITUTIONAL—are sometimes regarded and described under the name of "SPECIFIC DISEASES." The general theory regarding the nature of such diseases, so considered as *specific*, is thus expressed by Mr. Paget:—

"Each of them depends on a definite and specific morbid condition of the blood; and the local process by which each is made manifest is due to the disorder produced by the morbid blood in the nutrition of one or more tissues; and generally this disorder is attended with the accumulation, and leads to the discharge or transformation, of some of the morbid constituents of the blood in the disordered part. It is held, also, that in some of the SPECIFIC DISEASES the morbid condition of the

blood consists in undue proportions of one or more of its normal constituents—in others, again, some new morbid substance is added to or formed in the blood. In either case the theory maintains that the phenomena of each SPECIFIC DISEASE depend chiefly on certain corresponding specific materials in the blood, and that, if characteristic morbid structures be formed in the local process, these morbid materials are incorporated in the organs which are formed as the products of the inflammation."

In the preceding part of this Handbook the SPECIFIC DISEASES have been considered in two distinct classes—the division being founded on the fact that in the first class, or ZYMOTIC DISEASES (comprehended in Vol. I.), *the chief or essential constituent of the morbific agent enters the body from without;* while in the second class, or CONSTITUTIONAL DISEASES, *the essential constituent of the morbific agents appears to be inbred in the body, and makes itself manifest by various constitutional indications previous to the development of local lesions, or the characteristic expression of the disease by other phenomena.* There is sufficient circumstantial evidence with regard to all of these diseases, and absolute proof with regard to some, that there is—(1.) A morbid condition of the blood; (2.) That the nature of that condition is, in many, definite and specific, inasmuch as it may be produced at will by the introduction of a definite substance into the blood, which then manifests itself by establishing a local disease, and which, within certain limits, has constant characters; (3.) That the morbid matter or poison by which the condition of the blood is changed may accumulate or augment in quantity and virulence, and at length may be discharged in various ways from the body, and under a variety of organic forms, chiefly through the excretory products. But some are also discharged at the seats of local lesions which are set up, the morbid poisons being for the time accumulated in the morbid structures.

As far as some of the *miasmatic diseases* are concerned, such as *typhus and typhoid fevers, erysipelas, scarlet fever, cholera,* and the like, there is undoubted evidence of a morbid material in the blood, although it has never been isolated nor proved to exist in the products of the local morbid processes or specific lesions. In many of the *constitutional diseases,* too, similar evidence exists of a morbid matter *inbred* in the blood.

It will soon appear obvious to the student that the diseases already considered differ very materially in their nature from many *local diseases* about to be noticed. While the LOCAL DISEASES may be regarded as *common* or *simple* diseases, those already noticed are so very distinct from them, and are possessed of such constant features by which they may be distinguished from the local, common, or simple diseases, that they are frequently described under the term "SPECIFIC."

Certain types of morbid local action, however, are common to both; and therefore the SPECIFIC DISEASES have some constant and characteristic modification, or something in addition which distinguishes them, such as *syphilis, gout, rheumatism, tuberculosis,* and the *eruptive fevers.* These additional elements appear to consist—

1. In a certain constancy and regularity of development, metamorphosis, duration, and decline, during which certain common morbid processes become modified according to the *special* nature of the disease. "In some the most evident specific characteristics are peculiar affections of the movement of the blood, as in the *cutaneous exanthemata;* in some, affections of certain parts of the nervous centres, as in *tetanus, hydrophobia, hooping cough,* and *asthma;* in some, peculiar exudations from the blood, as in *gout,* and the *inoculable diseases;* in some, peculiar structures formed by the exuded materials, as in *variola, vaccinia,* and other *cutaneous pustular eruptions;* in some, destruction of tissues, as in the *ulcers of syphilis,* the *gangrene of ergotism,* and the *sloughs of boils* and *carbuncles;* in some, peculiar growths, as in *cancers;* in some, or indeed in nearly all, peculiar methods of febrile general disturbance" (PAGET).

In the specific diseases the phenomena of these local and general morbid processes are concurrent.

2. The most striking feature (assuming specific diseases to be due to the presence of morbid poisons in the blood, which, by a morbid process, is again separated from it, and eliminated from the system during the progress of cure) is that "the whole blood for a time seems diseased, and nearly every function and sensation is more or less disturbed from its health; and the patient feels 'ill all over' before the local disease appears" (PAGET).

In the common or local diseases, on the other hand, the local phenomena precede the general or constitutional disturbance.

3. There exists in both classes of the SPECIFIC DISEASES now described an apparent want of proportion between the cause and the effect. Thus, in *small-pox, measles, hydrophobia, bites of poisonous serpents,* or *syphilis,* the severity of the disease does not bear any proportion to the amount of poison applied; and numerous diseases have been described in which the morbid poison appeared to act with so much intensity, and produced such severe forms of disease, that the patient died before local lesions had time to become developed—*e. g.,* in *typhus fever, specific yellow fever, paludal fevers, scarlatina,* and the like.

The student is referred for more information on these important topics to what has been already written at pages 195 and 784, *et seq.,* vol. i., of this Text-book, and also to Lecture XX., on "Specific Diseases," by Mr. Paget, in his work *On Surgical Pathology.*

Of the two classes of SPECIFIC DISEASES, those which have been described as CONSTITUTIONAL or *inbred* appear to be, in their origin, essentially *blood diseases,* the disturbance due to their development being indicated by what has been termed a *cachexia.*

Those of the ZYMOTIC class, again, recognize the introduction of *materies morbi* from *without,* and symptoms arise which indicate much constitutional disturbance. But, in whichever way these diseases are brought about, their specific nature is such as has been described. Under the term *dyscrasiæ,* the specific condition of the blood in such diseases was wont to be described by many continental pathologists, implying a defective organization or elaboration of the circulating fluid. We cannot yet, however, associate particular diseases with definite and particular morbid states of the blood, however certain we may be that changes of a morbid nature do so exist; and therefore the term *dyscrasiæ,* as applied to designate such states, is premature in application, and has not come into general use, because it takes for granted more than is known.

CHAPTER VI.

GENERAL MANAGEMENT OF THE SYSTEM LIABLE TO CONSTITUTIONAL DISEASES.

IMPORTANT general indications for the treatment of the CONSTITUTIONAL diseases are suggested by their pathology as expounded in these pages. This general treatment ought to be directed towards the management of the system for the *prevention, control,* or *arrest* of the development of such affections, or to maintain them within such limits as are consistent, at least, with the well-being of the individual.

The topics to be noticed under this head are of so comprehensive a scope that they can only be indicated as shortly as possible, with the object of directing the mind of the student to their more extended study. They embrace, in fact, the whole subject of general and individual hygienic management. The student is therefore referred at once to two standard authorities, with whose maxims and practice his mind ought to become most thoroughly imbued, in order to direct successfully the measures for the prevention and arrest of the CONSTITUTIONAL DISEASES. The works here referred to are—(1.) *The Management of Infancy,* by Dr. Andrew Combe, ninth edition, 1860, edited by Sir James Clark; (2.) *Practical Hygiene,* 1864, the work of my colleague, Dr. E. A. Parkes, which has passed into a new edition. From the first of these books the student will learn how he must begin at the very beginning. He will learn to appreciate the influence of the constitution of parents on the health of their children, and will learn from it how to direct the management of infant life. From the second work he will learn how he may carry out the details of practical hygiene. This work of Dr. Parkes brings together an amount of material which shows to what extent exactness and certainty have been imparted to the science of Medicine. It is a work which will mark a new era in Practical Medicine.

From the nature of the CONSTITUTIONAL diseases (fully expressed at pages 1 to 5 of this volume, and described in the subsequent pages), it is to be noticed that there are three periods in the

history of these diseases necessary to be recognized in the pathology and treatment of them. The first period may be described as *the period of their constitutional development.* During this period the Physician is rarely if ever consulted, unless a constitutional tendency to the disease is suspected, obvious, or perhaps hereditary. The second period may be described as the period during which the *constitutional disease is fully expressed* by the phenomena and symptoms already described as peculiar to each of them. The third period in the history of these diseases may be described as a *series of intervals,* during which the health seems to be improved between the febrile paroxysms, or fully expressed conditions of ill-health. It is for the cure of the fully expressed disease that the Physician is generally consulted—a period when he knows he can do the least good. But when the public are aware of the extent to which health may be preserved, and constitutional diseases averted and mitigated by judicious management and treatment during the first and last periods here noticed, the Physician will be more frequently consulted as to how the health is to be so preserved and improved as to ward off CONSTITUTIONAL DISEASES.

Whenever the Physician has to treat any of these constitutional affections in their fully expressed condition, if he is successful in subduing the symptoms for the time, by means of the treatment already mentioned under each of them, *the interval of comparative freedom from the paroxysmal expressions of disease is a time most precious, which ought not to be wasted, but which ought to be taken advantage of in preserving and improving the general health.* To effect this end there are three things to be considered in the management of the system during the intervals of comparative freedom from constitutional affections. These are—(1.) *Diet;* (2.) *The use of Water;* (3.) *The use of Wines and other alcoholic beverages.*

1. *With regard to diet,* one of the highest problems in physiology, as Dr. Parkes clearly enunciates, is so to regulate the supply of the *nitrogenous substances*—the *albuminates*—that the *digestive power* of the stomach and intestines may be increased, together with the *formative power* in the nitrogenous tissues, and the *eliminating powers* in the after-stages of assimilation (l. c., p. 132). All these three parts of the process must be duly balanced,

otherwise health is destroyed. Half-digested food in the stomach or intestines produces irritation. It undergoes chemical changes in the alimentary canal, and quantities of gas are given off. Dyspepsia or constipation may be produced, or an irritation causing a diarrhœa which fails to empty the bowels. The fæces then contain a large amount of nitrogen, especially after eating vegetable albuminates. The tissues are unable to appropriate the excess which remains in the blood. Urea and carbonic acid, which ought to be eliminated in normal abundance, fail to be provided for from the imperfectly oxidized products of disintegration, and irritation of eliminating organs is set up. It is highly probable that gouty affections arise in this way, and partly from the use of liquids which delay metamorphosis. A great excess of albuminates without other food produces marked febrile symptoms, malaise, and diarrhœa, and ultimately albumen may appear in the urine, or extensive irritation of the skin may supervene. To increase the adaptation of the albuminates, fats and salts must be added to the diet; and the supply of oxygen must be increased by exercise, or the supply of starchy foods which appropriate oxygen must be diminished. Lessening the supply of the albuminates effects a decline or loss—first, of the muscular system; and, at a later period, of the nervous system and mental powers. Such decline or loss may be delayed by increasing the supply of fats and starches, which by absorbing oxygen limit disintegration; and by perfect rest the loss of flesh may be still further delayed.

In the management of the system, therefore, the albuminous tissues can be, to a certain extent, brought under the control of the Physician by a judicious adaptation of diet and exercise alone, without the employment of drugs. Drugs, however, when judiciously employed, are important aids at two ends of the intestinal canal—namely, to aid primary digestion and to assist elimination.

Fatty aliments are essential to the formation of muscular, and especially also of nervous tissues. With the nitrogenous substances or *albuminates*, they are essential to the production of mechanical force. Animal fats appear easier of absorption than the vegetable fats; and the relative proportion of *fat* to *albuminates* ought to be as 1 or $1\frac{1}{4}$ to 2.

Starchy and *sugary food* save the *albuminates* and *fats* from

too rapid disintegration, so that, by a judicious employment of them in dietary, the elimination, and perhaps the formation of the albuminates and fatty tissues can be so modified that the administration or withholding of starches and sugars as articles of food must enter largely into the management of the system, according to the circumstances of the case, and the nature of the constitutional disease.

The production of *lactic acid* in the system seems probably connected with the metamorphosis of starch. To the constant introduction of an excess of alkali in the food, and the no less constant production of acid during the digestion of foods (especially starches, sugars, and fats), associated with the effects of respiration, are to be ascribed the singular alternation of acid and alkaline fluids in the body. The relative amount of *starch foods* to the *nitrogenous* or *albuminate* substances ought to be as $2\frac{1}{2}$ or $3\frac{1}{2}$ to 1. Excess of starches, sugars, and fat produce excess of fat; sometimes also acidity and flatulence; and the urine may become saccharine under excess of starch as an article of diet. *Salts* and *water* are essential articles of diet. *Lime,* in the form of *phosphate,* is absent from no tissue; and when tissues degenerate and morbid growths are overgrown, or begin to decay, or when cells grow rapidly, as in *enchondroma,* lime is present in large amount. Both *lime* and *magnesia* are essential to the growth and repair of bone; and the judicious withholding of *lime* and *magnesia* in food is an important element in the constitutional management of diseases where the bones are affected, and in the repair of fractures. *Potash* and *soda,* in the form of *chlorides* and *phosphates,* are not less important constituents of diet. They form part of almost all the tissues; and, being especially concerned in the molecular currents amongst the elements of texture, seem to be less fixed than the magnesian and lime salts. The potash seems especially associated with the formed elements of texture, such as the blood-cells and the muscular fibres; while the soda salts are more largely concerned with the fluids which encompass these elements. These two alkalies (*potash* and *soda*) have been seen to be most important remedial agents in many diseases. *Chlorine, chloride of sodium, phosphoric acid, sulphur,* and *iron* must be furnished in all food, either separately or combined with the foods already noticed.

The salts which form carbonates in the system, such as *lactates, tartrates, citrates,* and *acetates,* exist chiefly in fresh vegetables; and although their nutritive power otherwise is small, it is absolutely necessary that they be supplied in the food. Scorbutic states inevitably ensue if they are withheld.

These are the main points to be inquired into and provided for in adjusting the diet best adapted for the management of constitutional diseases. Every intelligent patient may aid his physician, however, thus far—namely, that if he consider the subject *bonâ fide* for himself, he will become the best judge of the exact diet which suits him. Dr. Parkes observes that probably 30 *per cent.* of the persons who consult physicians owe their diseases in some way to food, and in many cases they are perfectly aware themselves of their error or bad habit; yet, with the singular inconsistence of human nature, either conceal it from the man to whom they are professing perfect openness, or manage to blind themselves to its existence (l. c., p. 461). Individual hygienic management must be inculcated upon the patient; while, by regulating diet on the principles laid down by Dr. Parkes in Chapter V. of his great work *On Practical Hygiene,* the physician will find he can exercise a great power in the control and limitation of constitutional disease. Most valuable information respecting the adjustment of the dietary will be found in Dr. Edward Smith's *Practical Dietary;* and in *A Manual of Diet and Regimen for Physician and Patient,* by Dr. Horace Dobell.

2. *With regard to the use of Water,* its influence as an agent in the management of certain conditions of constitutional ill-health is apt to be too much neglected, or not sufficiently appreciated. Ever since the powerful agency of water, under the popular name of the "*water cure,*" has been so much bequacked, the medical profession have almost allowed themselves to be seized with a kind of *hydrophobia.* Nevertheless, there can be no doubt that water has a most powerful influence for good or evil in the treatment of constitutional diseases. Under its influence as a fluid of daily consumption considerable chemical changes are promoted in the body. In the intervals between the extreme expressions of constitutional diseases, such as *gout, rheumatism, asthma,* and the like, it is a useful and most efficient remedial agent, not only as a diuretic, but also as a

local application, especially in obviating the congestions of the viscera associated with these constitutional affections (SIMON). "To accelerate the defective textural metamorphosis or waste is very often the practical result to be aimed at, and such means exist in the simplest and most manageable form in many of the appliances of the so-called '*water cure.*' With increased water-drinking there is increased discharge of solids by the urine. External appliances, such as the cold *sitz bath*, lasting a quarter of an hour, increase for a time the elimination of urea and uric acids. The protracted sudorific packings produce a still more considerable waste of tissue. Generally, therefore, in cases where the use of water is suitable, and conducted under competent medical advice and direction, the healthy nutrition of the body is promoted in proportion as refuse materials are actively disengaged" (SIMON, in Holme's *Surgery*, vol. i., p. 118).

3. *The properties of Wines, and of alcoholic beverages* generally, offer a wide and important field for the careful study of the physician. Although so extensively used as beverages with our daily food, and so generally recognized as valuable agents in the treatment of disease, there is not only great diversity of opinion as to their precise effects, but as yet very little is certainly known of the action of alcohol when administered in the forms of *Wine*, *Beer*, or *Spirits*. None of the general statements so frequently met with as to the composition or effects of any particular class of beverages can be relied on as a guide to the Physician in prescribing; and much error seems to prevail on the subject, not only in the popular mind, but amongst medical men.

Alcohol is the most potent agent for good or evil in all of these beverages; and, therefore, its amount and its effects challenge attention in the first instance. A pint of Beer (twenty ounces) may contain *one* or *two or more ounces of absolute alcohol*, or *less than a quarter of an ounce*. This alcohol may be associated in the beer with an amount of *free acid* varying from *fifteen* to *fifty grains*, and with an amount of *sugar* varying from *half an ounce* to *three* or *four times* that quantity. A glass of Sherry (two ounces) may contain from a *quarter* to *half an ounce or more of absolute alcohol*, with *sugar* varying in quantity from *a mere trace to twenty* or *thirty grains*, associated with *a very variable amount of free acid*, and with other ingredients. Even in Brandy or Whisky the amount of alcohol is widely different in different specimens.

It is impossible, therefore, for a physician to know what his patient is drinking unless he is acquainted with the chief constituents and their amounts contained in the identical liquor which he may prescribe; and of course, before sound conclusions can be arrived at, the conditions under which these beverages are administered or taken must also be very precisely observed.

The physiological effects of alcohol have been investigated and inquired into with considerable care by Rudolf Masing, Böcker, and Mulder; by MM. Lallemand, Perrin, Duroy; by Percy, Ogston, Bence Jones, Carpenter, Spencer Thomson, Hammond, T. K. Chambers, Edward Smith, Anstie, and Parkes.

All the observations and inquiries on this subject tend to the conclusion that *alcohol* passes through the body unaltered in chemical constitution, and does not, so far as we know, leave any of its substance behind. At the same time, there is ample evidence to show that a very large amount may be retained in the fluids of the brain for an indefinite length of time (PERCY, AITKEN, and others, see vol. i., pp. 829 to 834). During that period of retention it exerts an influence for good or for evil; and although it may not be regarded as an "aliment" in the strict sense of that term, it undoubtedly aids the appropriation of aliment under some circumstances; and so far may be regarded as an "accessory to food" in comparative health, or as a "*medicine*" in disease. Under this aspect of the subject, Dr. T. K. Chambers, in his interesting clinical lectures (p. 570), lays down the following rules for the administration of alcohol:—

1. Alcohol may be given with advantage when the nervous system is exhausting itself, and when the tissues of the body generally are being exhausted by an activity in excess of the other bodily functions. It lessens the destructive metamorphosis which goes on; and chemical changes in the blood are partially arrested (HARLEY, quoted by PARKES).

2. It must be given, increased in amount, or left off, under the guidance of the appetite for food. As long as a person in ill-health takes and digests food better with alcohol than without, so long will alcohol be of service to him. Beyond this general statement there is no evidence. In *very small quantities* it appears to aid digestion in the stomach; in larger amounts it checks it. A moderate use of beer or of the weaker wines (*i. e.*, of pure unbrandied well-fermented wines) may increase appetite and improve

nutrition. On the other hand, the use of malt liquors (even when pure and good) is injurious to persons of sedentary habits, or unless much exercise be taken in the open air; but sound, well-fermented beer is the best of all dinner drinks *for persons of good digestion, who work hard in the open air* (DRUIT).

3. When the marked features of disease consist in the retention of effete matters which ought to be discharged, the use of alcohol must be totally abstained from, as for example in Bright's disease.

4. The daily allowance of alcohol ought to be divided into two or three doses only.

Under all circumstances its effects must be watched; for while it may sometimes be desirable to diminish the metamorphoses of tissue by its use, it must not be forgotten that large quantities of alcohol tend to cause an accumulation in the system of imperfectly oxidized bodies, such as *uric* and *oxalic acid.*

The general evidence also tends to show (but does not absolutely prove) that pure alcohol has its pernicious effects greatly lessened, and its good effects more powerfully developed, when highly diluted, and still more so by admixture with other substances, as the carbo-hydrates and salts contained in *beer* and *wines.* The use of strong wines (15 *to* 23 *per cent.*) undiluted should therefore be discouraged as much as possible; and if such an amount of alcohol is found necessary for the due preservation of the wine, and naturally results from the fermentation of the grape, the wine ought to be diluted with water when used as a beverage. On the other hand, light wines cannot be long exposed to the atmosphere without acetous fermentation commencing in them. Light wines with a small amount of alcohol for the use of invalids must therefore be preserved in bottles of such a size that the whole may be consumed in a day; for much mischief may arise if wines are used by invalids after acetous fermentation has commenced. Besides alcohol and ethers, wine contains several substances of great value as articles of diet,—namely, some albuminous substances, such as *sugar,* as well as other carbo-hydrates, and abundant salts. The vegetable salts are most valuable, and in this respect are highly antiscorbutic (PARKES, l. c., p. 227).

For the purposes of the Physician, the prominence of certain substances in wines renders some more desirable than others, or more useful as "*medicines.*" These substances are—(1.) *alcohol,*

(2.) *acids*, (3.) *sugar*, (4.) *solids* or *extracts*. Of these in their order:—

Alcohol, to a variable amount, ought to exist in wines *as a natural product of the fermentation of the grape;* and the conditions of its existence in the wine are then very different from those which obtain when alcohol (distilled even from wine) has been added to wine. It is highly desirable, therefore, to avoid adventitious alcohol; but it is impossible to prove that spirit has been added to a wine unless the amount is absurdly excessive. One vintage sometimes produces a wine with a considerably greater amount of *alcohol* than another of the same vineyard. For example, the samples tested in London (for duty) of *Chateau Lafite*, of vintage 1858, showed 16·5 *per cent.* of proof spirit; the same vineyard in 1859 showed 17·7; and in 1860 it gave 14·8; —the three years varying about 3 *per cent.* The samples of common *St. Emilion* in 1858 showed 16·5 *per cent.* of proof spirit; in 1859 the same vineyard showed 15·4 *per cent.;* and in 1860 it gave 16 *per cent.;*—thus not differing more in the three years than about 1 *per cent.*

The amount of the alcohol by measure may be most readily estimated by the vaporimeter of M. Geisler, of Bonn, which indicates the amount of the alcohol by the tension of vapour at a certain temperature, from the fluid containing the alcohol forcing up a column of mercury. Dr. Parkes gives also a very ready process by evaporation, and the use of a urinometer (*Practical Hygiene*, p. 220).

Having thus ascertained the *per centage* of alcohol in *wine, beer*, or *spirits*, it is easy to calculate by simple proportion the dose of alcohol administered. For example, a pint bottle of Claret (*thirteen* ounces), of the strength of *eleven per cent.* of alcohol, will be found to contain 1·43 ounces of absolute alcohol, thus:—

$$100 : 11 : : 13 = 1{\cdot}43.$$

It is the basis of the rule laid down by Dr. Parkes (l. c., p. 224), which says,—"*To tell how much pure alcohol is taken in any definite quantity of wine, measure the wine in ounces, and multiply it by the per centage of alcohol with a decimal point before it.*"

Acidity.—Free acid in wine is a necessary result of its fermentation. Its presence is likewise necessary for the evolution of the

bouquet, for the agreeableness of the wine, and for its wholesomeness. It is, therefore, a popular error to denounce absolutely the existence of acidity in wine. The *relative amount of free acid* present in any particular wine is a very important point to determine. Much error prevails respecting the relative amount of acidity in different wines, and an excessive amount of free acid is very easily disguised by the relative sweetness of the wine. The estimation of the free acid may be measured by a solution of carbonate of soda, containing 530 grains in the 10,000 grain measure = 53 grammes in the litre; and the amount of acidity is represented by determining how many grains of crystallized oxalic or acetic acid a certain quantity of the soda solution will neutralize. The details of the process are as follow:—

(1.) Take 50 or 100 c. c. of recently opened wine; (2.) Add from a burette a standard solution of soda, in small portions at a time (say 5 c. c., or drop by drop); (3.) After every addition, test the fluid by moistening a thin glass rod or feather with the mixture, and streak it across some well-prepared violet litmus paper; —when the streaks cease to become red, the analysis is complete; (4.) Estimate how much of the standard solution has been used, and express the acidity as equal to so many grains of crystallized oxalic or acetic acid. Good wine contains a quantity of acid that is equivalent to from 300 to 450 grains of crystallized tartaric acid in a gallon. Wines with less than 300 grains of acid in a gallon are too flat to be drinkable with pleasure. Wines with more than 500 grains in a gallon are too acid to be pleasantly drinkable; and wines with more than 700 grains in a gallon are undrinkably sour (Druitt's *Report on Cheap Wines*, p. 178).

It is also very important to get at the *quality* of the acid,—to the extent, at least, of dividing the *volatile* from the *non-volatile* (and less digestible acids). A large amount of acid and acid salts may not be readily digested; and in many diseases the supply of acid to the system is a thing to be desired or prevented (see also PARKES, l. c., p. 219).

The necessary standard solutions and burette apparatus are supplied by Mr. Griffin, 119 Bunhill Row, who has prepared a set of apparatus which shows all that chemistry can teach of the quality of wine; by Messrs. Bulloch & Reynolds, Hanover Street, London; also, Harper & Sutton, Operative Chemists, Norwich.

Sugar is characteristic of all the *sweet* wines, and of many wines

in their immature condition. Its amount tends to diminish with age, so that old wines of the *sweet* sort may be less pernicious, as regards sugar, than the new. *Sweet* wines, or wines which contain a large *per centage* of sugar, are to be avoided by those who are disposed to corpulence; and they are extremely injurious to those who are disposed to the formation of *oxalic acid*, or to the discharge of sugar in the urine. Its amount in any particular sample of wine is best determined by Soleil's *saccharimeter*. The principle on which the process depends is that the varieties of sugar possess the power of twisting the plane of polarization of a ray of polarized light which is transmitted through solutions containing these varieties of sugar. *Cane sugar* and *glucose* twist it to the right hand; *fruit sugar* twists it to the left hand. All gradation lists given in books as to the amount of sugar in wines are purely empirical, and apply only to the particular sample of wine examined. In stating the sweetness of Champagne, for example, nobody seems to notice that it is a manufactured article; and that the quantity of *syrup added to it* actually varies from *four* to *twenty per cent.* The Champagne known as "*still*" has no sugar. Some sorts of Madeira are also nearly free from sugar; and some sorts of Sherry are much sweeter than well-fermented Ports.

The co-relation of sweetness with acidity and with alcohol are most important points to be determined with reference to the easy digestion of wines; and hence they are all-important for the Physician to know.

The Amount of Solids may be learned (approximately) by determining the specific gravity after the alcohol is driven off. A low specific gravity shows that alcohol has been added, or that the solids are in small amount (PARKES, l. c., p. 226).

The following table gives a standard for the determination of the solids (PARKES, l. c., p. 218):—

Specific Gravity after loss of Alcohol.	Per Cent. of Extract.	Specific Gravity after loss of Alcohol.	Per Cent. of Extract.
1004, ...	1	1024, ...	6
1008, ...	2	1028·1, ...	7
1012, ...	3	1032·2, ...	8
1016, ...	4	1036·3, ...	9
1020, ...	5	1040·4, ...	10

It is much to be regretted, especially for the sake of invalids, that so few wine merchants are acquainted, or care to be

acquainted, with the chemical constituents of their different wines. Medical men should, therefore, deal only with those wine merchants who will tell them the amount at least of the several constituents in their wines that have been referred to—namely, of alcohol, acids, sugar, solids—and who will guarantee the wine they supply as being in accordance with the sample of which they give the analysis. The sale room of every wine merchant ought to be provided with the means and appliances here indicated for ascertaining the exact amount of the substances contained in the samples of wine they offer for sale. The *amount of alcohol, of free acid, of sugar, and of solids* should be recorded also of every wine on importation, so that the wine merchant may be able to watch the metamorphoses, in respect of these constituents, effected on them by lapse of time. Wine merchants could thus materially assist the efforts of medical men in the cure of disease, and Physicians could then prescribe with some knowledge of what they were prescribing; and to that extent, at least, the welfare of invalids and the sick would be better cared for.

But although by ascertaining these facts a Physician may prescribe with better knowledge of what he is prescribing, and to that extent at least be better able to care for his patients, it must not be concluded that chemistry can detect every form of adulteration in alcoholic beverages. As Dr. Druitt justly observes, —"the only real test for wine is the empirical one. It is impossible to say that such a wine must be good in such and such cases, because it contains certain ingredients. . . . The stomach is the real test-tube for wine; and if that quarrels with it, no certificate of Liebig and no analysis are worth a rush" (*Report on Cheap Wines*, page 6). With all possible aids, the one safeguard against fraud is to deal only with wine merchants and brewers of established character and reputation, who will be above attempting to dispose of unsound or adulterated liquors; and to avoid being tempted by the low prices of amateur dealers in wine, or of advertising companies and others, obviously more anxious to sell than to sell only the purest and the best.

The principal analyst of the Inland Revenue department reports that he found illicit ingredients in no less than twenty out of twenty-six samples of Beer tested last year (1865); and he believes that, owing to the difficulty of detection, the practice

of adulterating Beer with poisonous ingredients is much more prevalent than might be inferred from the small number of discoveries made. These samples were all from the stores of licensed brewers; and although, doubtless, further adulterations are practised by the retailers, they are probably for the most part with less noxious materials, and chiefly with the object of increasing bulk—known as "*stretching*." As to Wines, the following advertisement, frequently appearing in the *Times*, shows that there is a trade openly carried on in this country in the treatment or *cure* of bad or spurious Wines:—

"Wine merchants having wines turned acid may have them returned to their original wholesome perfection in two or three days, by applying to ——," &c., &c.

It is well known that the same practices prevail abroad, so that "pure as imported" is now no guarantee for purity of production. Hambro' wine has been shipped from London to Cadiz and back—an operation which raises the price of the stuff 100 *per cent.* The custom-house officers have lately (1865) stopped a large quantity of stuff imported as "Sherry," which had not a drop of grape-juice in its composition; and it cannot be doubted that the increased consumption and increased competition for low prices have greatly added to the temptations to adulterate. Such liquors, for any medicinal purposes, must be worse than useless; and whenever Wine, Brandy, or Beer is prescribed medicinally, they ought to be obtained from wine merchants or brewers of the highest respectability. Wine merchants are generally quite willing to sell in small quantities either wine or spirits—a recent change in licensing laws enabling them to do so, and so making it no longer necessary to send to the public-house when only a single bottle is wanted.

The blindly empirical and routine mode in which alcoholic beverages are generally prescribed, in absolute ignorance of their constitution and genuineness, and the importance of them in the treatment of disease or of ill-health, renders it advisable in a text-book to insist fully on these topics; believing that the Physician cannot cope successfully with diseases, and especially with CONSTITUTIONAL DISEASES and the ill-health with which they are associated, unless he learns judiciously to use the immense power at his disposal in the influence of *diet, water,*

and alcoholic beverages, as agents in the management of the system during the intervals between the paroxysms of these diseases. For much valuable information on wines, given in a very pleasing form, the reader is referred to *Report on the Cheap Wines from France, Italy, Austria, Greece, and Hungary; their Quality, Wholesomeness, Price, and their Use in Diet and Medicine,* by Robert Druitt, Esq., F.R.C.P., 1865.

CLASS III.

LOCAL DISEASES; OR, DISEASES IN THE COURSE OF WHICH CERTAIN LESIONS COME TO BE LOCALIZED.

CHAPTER I.

GENERAL NATURE OF THE DISEASES COMPREHENDED IN THIS CLASS.

THIS class is intended to comprehend all those diseases which affect the structure of special organs or particular parts of the body, which lead to marked disturbance of their functions.

Local affections are often accompanied by constitutional symptoms. Such symptoms are to be regarded as secondary when they succeed to and depend upon the existence of the local lesion. Many diseases where the lesions are strictly localized and defined are really the results of *constitutional* or *zymotic* disease; and many have been already described under the several diseases that have been considered in the previous pages of this work. The local affection in such cases is often so striking and important that it has especially challenged attention, while the constitutional state from which it may have sprung is as yet concealed and unknown. Not a few cutaneous eruptions are of this nature; so also are some forms of dropsy.

The diseases about to be considered are essentially characterized by more or less defined local lesions, of the nature of—(a.) *Catarrh,* or increased flow of secreted fluid; (b.) *Inflammation of the suppurative, ulcerative, plastic, pyæmic, rheumatic, gouty, syphilitic, scrofulous,* or *gonorrhœal;* of the nature of—(c.)

Gangrene; (d.) *Passive congestion;* (e.) *Extravasation of blood,* or hæmorrhage; (f.) *Dropsy;* (g.) *Fibrous deposits;* (h.) *Altered dimensions,* as *dilatations, contractions, hypertrophy, atrophy;* (i.) *Degenerations, amyloid* or *lardaceous, fatty, atheromatous, pigmental, calcareous, fibroid;* (k.) *Syphilitic;* (l.) *Cancer;* (m.) *Non-malignant tumors;* (n.) *Cyst;* (o.) *Scrofula, with or without tubercle;* (p.) *Parasitic lesions;* (q.) *Calculus and concretions;* (r.) *Malformations;* (s.) *Injuries;* (t.) *Functional diseases.*

CHAPTER II.

GENERAL REMARKS ON THE PATHOLOGY OF BRAIN DISEASES, AND DISEASES GENERALLY OF THE NERVOUS SYSTEM.

It is with nerve-texture, as composing the essential parts of the nervous system contained within the cranium, and distributed as nerves throughout the body, that we have to deal in describing the local diseases of this order.

The interest which attaches itself to the study of the nervous system cannot be surpassed either in a physiological or pathological point of view. The truth and force of this statement will be more especially apparent when it is remembered that the nerves are the channels of Sensation; that nervous textures compose the organs which conduct the influence of the Will to the muscles, before motion can take place; and that while the textures which constitute the *nervous centres* associate Sensation on the one hand, they at the same time balance and co-ordinate the motions of the body on the other. And that, lastly, being the seat of the various mental processes through which *Sensation, Volition, Memory, Judgment,* and *all mental acts* are expressed, the pathological relations of the nervous texture contained within the cranium or distributed throughout the body, are perhaps the highest and most important, in a scientific, philanthropic, and sanitary point of view, to which the mind of the physician can be directed.

The student is therefore called upon to give the Brain diseases

and those of the Nervous System generally, a large share of his study.

The varied phenomena connected with the morbid conditions of the nervous system must be examined from the following points of view, namely—(1.) The purely anatomical structure of the Brain and Nerves; (2.) The chemical composition and properties of the nervous substance; (3.) The physiological relations of the several parts; (4.) The morbid and pathological relations. Each of these methods of study and investigation will mutually illustrate one another; and it is only from a consideration of all of them conjointly that we can arrive at the Natural History of a case, and so act for the best in diagnosis, prognosis, and treatment. Every student knows how very many physiological doctrines regarding the Brain and Nerves receive elucidation from accurately determined anatomical information; and so such knowledge tends to explain various points in the pathology of cerebral diseases. He need only be here reminded of the phenomena explained by the decussation of the *pyramids* in the *medulla oblongata;* how the continuity of the fibres of the spinal cord upwards to the *cephalic centres* explains various secondary lesions of the brain as a consequence of lesions in the spinal cord altered by paralysis (Drs. Brown-Séquard, Turck, and Waller); and, lastly, the interesting observations made by Drs. Walshe and H. Bence Jones regarding the excretion of sulphates and phosphates by the urine in *acute chorea, delirium tremens,* and *inflammation of the brain* itself. These observations show, to some extent, how accurate chemical and anatomical investigations may become valuable in the elucidation of morbid phenomena occurring in living bodies.

Anatomical Constituents of the Brain and Nerves.—The nervous texture may be simply considered as arranged into three great divisions:—

1. A large quantity of nervous matter collected into one mass, and contained in one cavity, the cerebro-spinal. This mass is called the *Brain and Spinal cord,* or *Encephalon,* or *Cerebro-spinal axis,* or *central part of the nervous system;* and is composed of the *cerebrum, cerebellum, sensori-motor ganglia,* and *spinal cord.*

2. A nervous texture, arranged in the form of long, continuous cords or threads, mutually connected, and running in every

direction throughout the body. These are simply called the *Nerves.*

3. An accumulation of peculiar nervous substance, in the form of small, round, and somewhat oval masses, called "*ganglia,*" variously connected with each other, and with the surrounding parts, and forming what is known as the *Sympathetic system.*

Chemical Composition of Brain and Nerve-Tissue.—The white or grey matter of the brain has been generally taken to represent pure nerve-substance. It consists of albumen, fatty matter, salts, and from $\frac{4}{5}$ths to $\frac{7}{8}$ths of water. The fatty constituents are remarkable, inasmuch as two of them, being acid compounds, contain a large amount of phosphorus, from 8 to 10 parts in 1,000 of the mass, or $\frac{1}{20}$th to $\frac{1}{30}$th of the whole solid matter. This is continually being metamorphosed during functional and morbid changes of the nerve-substance; and the amount of alkaline phosphates in the urine may be taken in some measure as an estimate of the amount of nerve-tissue disintegrated, the earthy phosphates being disregarded, inasmuch as they have been shown mainly to depend on the quantity taken in the food. The phosphorus set free by disintegration of the nervous tissue unites, in the form of an acid, with the alkaline basis in the blood, and is thence separated by the kidneys and discharged with the urine.

Weight of the Brain and its Parts.—In appreciating morbid states of the brain and nervous textures after death, it is useful to remember that the absolute and specific weights of the brain range within certain limits, consistent with the healthy exercise of function. The following statements are made of standard numbers for reference and comparison illustrative of this point:—

Absolute Weight.—The absolute weight of the brain or encephalic mass varies in concurrence with variations of age, body-weight, and height of persons; and generally it may be stated as in the following table, compiled from the valuable records communicated to the Royal Society on the 28th February, 1861, by Dr. Robert Boyd, the Physician to the Somerset County Lunatic Asylum:—

TABLE SHOWING THE RELATIVE AVERAGES OF BODY-WEIGHT AND THE WEIGHT OF CEREBRAL ORGANS AS TO AGE AND HEIGHT.

Age.	Sex.	Body-Weight.	Height of Body	Weight of Cerebrum.	Weight of Cerebellum.	Weight of Pons and Medulla.	Weight of Encephalon.
Years.		Lbs. Oz.	Inches.	Ounces.	Ounces.	Ounces.	Ounces.
1 to 2	Male,.....	14 6	28·5	29·21	3·54	·5	33·25
	Female,.....	13 2	27·7	26·19	3·15	·46	29·8
2 to 4	Male,.....	20 0	31·6	34·03	4·02	·66	38·71
	Female,.....	18 7·5	31·6	30·77	3·7	·5	34·97
4 to 7	Male,.....	25 8	37·5	35·44	4·17	·62	40·23
	Female,.....	24 9	37·0	35·04	4·19	·68	40·11
7 to 14	Male,.....	42 6	47·0	40·36	4·84	·76	45·96
	Female,.....	38 6	45·0	35·86	4·27	·65	40·78
14 to 20	Male,.....	68 0	60·5	41·77	5·32	1·0	48·54
	Female,.....	63 14	57·7	38·88	4·65	·85	43·94
20 to 30	Male,.....	92 14·5	66·75	41·98	5·19	·93	47·9
	Female,.....	86 13	62·0	38·0	4·82	·88	43·7
30 to 40	Male,.....	98 3·5	66·5	42·06	5·15	·98	48·2
	Female,.....	87 0	62·0	37·92	4·74	·91	43·09
40 to 50	Male,.....	102 0	66·8	41·48	5·22	1·06	47·75
	Female,.....	84 9·5	62·0	37·12	4·69	·89	42·81
50 to 60	Male,.....	102 0·5	66·0	41·09	5·13	·98	47·44
	Female,.....	86 0	62·0	37·38	4·62	·86	43·12
60 to 70	Male,.....	103 13	65·7	40·21	4·98	·97	46·4
	Female,.....	86 14	61·5	37·13	4·68	·83	42·69
70 to 80	Male,.....	106 13	65·7	39·6	4·97	·94	45·5
	Female,.....	80 4	61·0	35·58	4·47	·88	41·27
80 to 90	Male,.....	99 0	66·7	39·62	4·79	·89	45·34
	Female,.....	79 0	60·0	34·47	4·47	·82	39·77

It is by accurate observations such as these that the gradual growth of every organ of the body is demonstrated to advance slowly and in concurrence with advancing age and increase of

body-weight. It is now also a matter of experience, although too often overlooked, that the functions and organs of the body, and by no means rarely the brain and the Intellect, may be injured for life by pressing upon them too hardly and continuously in early years. Whatever theory we hold (as to the functions of the brain or Mind), "it is certain that the powers of the brain are only gradually developed; and that if forced into premature exercise, they are impaired by the effort. This is a maxim, indeed, of great import, applying to the condition and culture of every faculty or function of body and of Mind, and singularly so to the Memory, which forms in one sense the foundation of intellectual life. A regulated exercise *short of fatigue* is improving to it (and to all faculties or functions), but we are bound to refrain from goading it by constant and laborious efforts in early life, and before the instrument is strengthened to its work, or it decays under our hands" (Sir Henry Holland's *Mental Pathology*).

Bulk.—The bulk of the encephalon varies from 65 to 84 cubic inches.

Specific Gravity.—The result of recent observations in Germany, France, and Britain, shows that any considerable change in the specific gravity of the cerebral substance is incompatible with a healthy exercise of the nervous functions.

To Dr. John Charles Bucknill, Physician to the Devon County Lunatic Asylum, medical science is indebted for the first most extended account of the specific gravity of the cerebral substance, and its relation to disease, and more especially to *atrophy* and *paralysis*. The following are the general results of his observations as detailed in *The Lancet*, 25th December, 1852, and for the most part made upon patients labouring under different forms of mental disease:—

(1.) Average specific gravity of healthy brain, 1·036. (2.) In paralysis of a chronic character, complicated with insanity, the specific gravity ranged between 1·036 to 1·046. (3.) In some acute cases the specific gravity was as high as 1·052. (4.) In paralysis terminating by coma, 1·040. (5.) In paralysis terminating by syncope or asthenia, 1·036 to 1·039. (6.) In general terms, a higher specific gravity was found when life terminated by coma or asphyxia, than when it ended by syncope or asthenia.

In addition to these observations, an able and elaborate paper

has since been published by Dr. Sankey, showing the relative specific gravity of the *grey* and *white matter* of the brain, and of so extensive a nature as to furnish very copious data for comparing morbid states with the standard of health. The following are the general results of his researches, as given in *The British and Foreign Medico-Chirurgical Review* for January, 1853, p. 257:—

(1.) Mean specific gravity of the grey substance of the brain in either sex, 1·034. (2.) In the earlier and later periods of life the specific gravity of the grey matter is below the mean. (3.) The cerebral substance acquires its greatest density in males between the ages of fifteen and thirty, and in females between the ages of twenty and thirty. (4.) The density diminishes with prolonged illness. (5.) It decreases with a lapse of time after death in the ratio of ·001 for every twenty-four hours. (6.) A density of ·006 above the average indicates the existence of the following conditions during life:—Acute cerebral symptoms, or chronic disease with no cerebral symptoms, or only slight delirium; also with conditions associated with hyperæmia. (7.) Mean specific gravity of white matter, 1·041.

Both sets of observations referred to above have been made upon the brain as a whole; and as the observations of Dr. Sankey show that no constant relation exists between the absolute weight of the brain and its specific gravity, it is necessary to examine the brain as we do its anatomy—namely, by comparative observations on its *central parts* or *ganglia*.

At the time Dr. Bucknill published his observations I was engaged in determining the specific gravity of the central parts of the brain, which are sometimes called the *central ganglia*, and which are now generally regarded as the parts more immediately related to the combined exercise of sensory and motor functions. These centres consist of the *corpora striata; thalami optici; tubercula quadrigemina; and the large mass of vesicular nervous matter associated with the convolutions of the hemispheres and the substance of the cerebellum.* While these parts are the immediate seats of the origins of the nerves, they may be looked upon as parts where some changes in connection with the functions of special nerves are constantly going on, of such a kind that a result is expressed through "Volition, Perception, or Emotion, or the balancing or co-ordinating of movements" (Todd.)

These parts have a specific gravity as follows:—The central ganglia, 1·040 to 1·047; the cerebrum, 1·030 to 1·048; the cerebellum, 1·038 to 1·049.

The same kind of morbid states which modified the specific gravity of the brain-substance, as recorded by Drs. Bucknill and Sankey, also manifest their influence on the central parts. Thus death by *coma*, and especially in *typhus fever*, was indicated by an extremely high specific gravity; and while it was observed that a slight difference was common in most cases when similar parts on opposite sides were compared, it is presumed that further observation, extended in this direction, especially in cases of hemiplegia, may lead to important results. In one case of *choreic hemiplegia* which I had an opportunity of carefully investigating, the specific gravity of the *corpus striatum* and *optic thalamus* on the right side was found to be 1·025, while the specific gravity of the corresponding parts on the left side was observed to be 1·031 (*Glasgow Med. Journal*, No. I., 1853).

Pathological Relations of the Nervous Organs and Texture.—Our knowledge of these relations is necessarily imperfect, and for the following reasons:—(1.) The functions of the various parts which, connected together, constitute the encephalon, are not yet determined accurately. (2.) The inconstancy and irregularity of the functional disorders which accompany the morbid state of the nerve-substance render it difficult to interpret the value of the symptoms by which the *nervous diseases* are manifested. (3.) Some of the diseases of the brain and nervous system which are marked by the most violent symptoms during life, such as *epilepsy*, *chorea*, *tetanus*, and *hydrophobia*, leave after death no constant lesion capable of being detected with the unaided eye, or even by microscopic examination; while *tumors* and serious destruction of the nervous mass may exist during life without producing any severe or pathognomonic symptoms whatever. (4.) We have no means of applying physical diagnosis to the cranium, as we have to the chest, although it has been proposed by some (Drs. John Fisher and Whitney) to found diagnosis upon *Cerebral Auscultation*. For an abstract of the nature of the investigations "On the Auscultation of the Brain" the reader is referred to Wood's *Practice of Medicine*, vol. ii., p. 621, and also to a notice of Henning's "Inaugural Dissertation on the Sounds perceptible about the Head and at the upper portion of the

Spinal Column in Children," in *Med.-Chir. Review* for 1857, p. 528. also a treatise by Dr Henri Roger of Paris

The general principles on which the pathological relations of the *brain diseases* are determined, rest upon the anatomical, chemical, clinical, and physiological facts now accurately known. An accurate knowledge of anatomy is most essential in the study of disease of the nervous system.

In connection with the physiological view of the subject there are several cardinal facts which must be constantly kept in remembrance, and which may be shortly referred to here.

There are separate and distinct functions performed by the *grey* and *white* matter which enter into the structure of the nervous centres and organs. Reasoning from the general properties known to be possessed by cells in other structures, it is now a generally received doctrine, that the cells of the *grey* substance of the brain and nervous centres are the seat or source of that force which has received the name of the "*nervous force, nervous power,* or *nervous influence,*" and which makes itself known by *sensation* and *motion,* as also by the various ways in which the *mental acts* are expressed. The *white nerve-fibres* are in connection with the *grey* or *cell-elements* of the nervous tissue, conducting from and to these centres the "influences" which are sent to, or which originate there and are thence sent forth.

The union of the nerve-tubes with the nerve-corpuscles is supposed to be connected with the transference of action from one nerve-fibre to another, as in *reflex action.*

It is likewise a remarkable fact that each nerve-fibre in a fasciculus acts quite independently from end to end,—quite isolated from the others in its vicinity; and thus at once we have the enunciation of three distinct sets of physiological phenomena associated with the diseases of the brain and nerves.

First,—Phenomena of Isolated Conduction.—Exalted or diminished action is presented by that nerve-fibre only which is affected by the irritating or depressing cause, and the adjoining fibre, though in ever such close approximation, is not implicated.

Second,—Phenomena of Sympathy or Irradiation of Sensations. — That irritation is propagated from a fibre originally excited to other centripetal nerves.

Third,—The Phenomena of Intelligence.—The brain furnishes the conditions necessary for the manifestation of the

intellectual faculties, properly so called, such as the Emotions, Passions, Volition, and is at the same time essential to Sensation.

That the evolution of power or nerve-force immediately connected with Mind is dependent on or emanates from the hemispherical ganglia, is rendered probable by the following facts :— (1.) In the animal kingdom generally a correspondence is observed between the quantity of grey matter, the depth of the convolutions, and the sagacity of the animal. (2.) At birth the grey matter of the cerebrum is very defective, so much so that the convolutions are, as it were, in the first stage of formation, being only marked out by superficial fissures, confined to the surface of the brain ; and as the grey substance increases, Intelligence becomes developed. (3.) The results of experiments have shown that, on slicing away the brain, the animal becomes more dull and stupid in proportion to the quantity of grey substance removed. (4.) Clinical observation points out that in those cases in which the disease has been found to commence at the circumference of the brain, and proceed towards the centre, the mental faculties are affected *first*—*e. g.*, *meningitis*, and the like ; whereas in those diseases which commence at the central parts of the organ, and proceed towards the circumference, the mental faculties are affected last—*e. g.*, *tumors* in the central white substance.

The white tubular matter in the form of the diverging fibres of the brain conduct influences, originating in the *hemispherical ganglia*, to the nerves of the head and trunk ; while they also conduct, in an inverse manner, the impressions made on the peripheral parts up to the *cerebral convolutions*.

The spinal cord, by its connection with the brain, furnishes the conditions necessary for combined movements ; and that its nervous force is also dependent upon its grey matter is rendered probable by the following facts :—

(1.) The universal connection of the grey matter with all motor nerves. (2.) Increased quantity of the grey matter in those portions of the spinal cord whence issue large nervous trunks. (3.) The collection of grey matter in comparatively large masses at the origin of such nerves in the lower animals as furnish peculiar organs requiring a large quantity of nerve-power, as in the *Torpedo*, *Gymnotus electricus*, and *Silurus*. (4.) Clinical observation shows that in cases where the *central portion* of the cord is affected previous to the external portion, the individual

retains the sensibility and power of moving the limbs, but wants the power to stand or walk; whereas, when disease commences in the *meninges* of the cord, pain, twitching, convulsions, numbness or paralysis indicates lesion in the white conducting matter.

Independent endowment of nerves is shown by the fact that, whatever be the stimulus which calls their power into action, a uniform functional result is obtained; and hence it is inferred that the nerves are not altogether the mere conducting tubes of a stimulus from one place to another, but are in some respects the seats, or agents, or apparatus of power.

As far as we know, the brain alone furnishes conditions necessary for Intelligence, the spinal cord conditions essential to Movement; and together they furnish conditions connected with the balancing and co-ordination of motor and sensific power.

In dealing with the diseases of this order,—the *Cephalici*,—it is incumbent on the physician to ascertain, as correctly as possible, the *locality of the lesion, the nature of the affection*, and the *anatomical condition of the part affected.* Although it has been sometimes asserted that it is of little practical importance to discriminate accurately between diseases of one part of the brain or of its membranes and those of another, because the treatment may be the same for all, yet, for the sake of science—because "knowledge is power," and because the acquisition of such knowledge must eventually alleviate the sufferings and lessen the sorrows of humanity—the sooner such doctrines are ignored the better for the Science of Medicine; and, moreover, the majority of the medical profession are beginning to appreciate the principle that diagnosis should be carried as far as possible. To the advanced student, who would desire more minute information to guide him in the differential diagnosis of brain diseases than can be given in a text-book of medicine, he is recommended to study the work of Dr. J. Russell Reynolds, Professor of Clinical Medicine in University College, on the *Diagnosis of Diseases of the Brain, Spinal Cord, and Nerves*, as well as the writings of Dr. Sanders, of Edinburgh, Dr. H. Jackson, of the London Hospital, and Mr. Lockhart Clark, and the comprehensive manual of Tuke and Bucknill *On Insanity.* From these and other works the general remarks and descriptions of brain diseases have been mainly compiled; and the method of classifying the phenomena of these diseases adopted by Dr. Reynolds has been followed throughout this text-book.

CHAPTER III.

GUIDES TO THE DIAGNOSIS OF BRAIN AND NERVOUS DISEASES.

1. **As to Locality or Site of Lesion.**—As yet we are able only in some cases of tumors of the encephalon to define their locality, as to whether they are in the cerebrum, cerebellum, or central ganglia.

With regard to the cerebrum, it may be determined in the majority of structural diseases which lateral half is affected, and in particular cases it may be predicated with strong probability that the lesion is situated in some one of the following sites:—(1.) The substance of the hemispheres (cortical or central); (2.) The ventricles,—hæmorrhage into these cavities, for example, may sometimes be distinguished from effusion into the substance of the hemisphere; (3.) The base of the brain; or (4.) Its superior surface. Inflammation of the brain-substance and of the meninges presents different symptoms when occurring in the two last-mentioned situations.

In the present state of science we are unable to localize exactly either the diseases of the *cerebellum* or of the *central ganglia* of the brain from symptoms during life.

Diseases of the *pia mater* and *arachnoid* may be discovered by the history and progress of a case from those of the *dura mater;* and sometimes it is possible to distinguish *meningitis* of the base from that of the convexity of the brain, chiefly from the influence which the diseased *meninges* exercise upon the functions of the parts beneath. Disease of the *dura mater*, for example, may often also be inferred from morbid conditions discoverable in the organs of *special sense*, or from disease in the *bones* of the *cranium*, or of the *integuments* or *scalp*.

With regard to diseases of the spinal cord, similar grounds for diagnosis exist; and the locality of the lesion may often be correctly referred to the *anatomical regions* of the cord, to *certain columns* of its *substance*, to the *white* or *grey nerve-substance* of which it is composed, or to the *coverings*. It is of importance in cases of diseases of the nervous trunks to know which set of the cranial nerves are affected; and in relation to the spinal *nerves* it is necessary to distinguish diseases of the *anterior* from those of

the *posterior* roots, as well as the region of the cord from which the diseased roots proceed.

The grounds of diagnosis of the locality of nervous diseases generally may be summed up as follows:—

I. The *brain* is presumed to be the seat of lesion when several of the special senses are simultaneously affected; when *Perception, Ideation, Volition,* and *special Sensation,* are affected; when the muscles and general sensory nerves are implicated longitudinally and unilaterally (hemiplegia); when muscles situated so high as those of the face and tongue are involved, and the *orbicularis* of the eyelids does not share in their affection. In these rare cases of bilateral (or transverse) paralysis (paraplegia) resulting from some cerebral change, the symptoms at some period of the case have generally referred to the head (by their special character), so that, by a combination of the two classes of observations, the general diagnosis may almost universally be established.

II. The *spinal cord* is presumed to be the organ affected when the symptoms of motory and sensory character are distributed transversely or bilaterally, inducing paraplegia or transverse spasms; when the mental functions are unchanged. The precise locality may be estimated sometimes from anatomy of the spinal nerves. If the lesion or disease is high, speech, deglutition, or respiration may be impaired. There is often erection of the penis, and the retention or voluntary discharge of fæces or urine.

III. The *nerve-trunks* are presumed to be the seat of lesion when the symptoms are referable to an isolated muscle, or group of muscles, or to a small portion of the sensory surface. When paralysis is the symptom, the irritability of the muscles to electric stimulation is quickly lost, and the symptoms show no disposition to wander from the special localities affected (Reynolds).

The distinguishing characters of *meningeal* from *cerebral* diseases may be arranged in the following tabular form, for comparison and reference:—

CEREBRAL DISEASE.	MENINGEAL DISEASE.
1. From the outset, or from a very early stage of development, there is loss of some one or more of the proper nervous functions, such as paralysis, anæsthesia, loss of memory.	1. It is not till some time after the detection of signs of disease that diminution or loss of nervous function takes place.

CEREBRAL DISEASE—*continued.*	MENINGEAL DISEASE—*continued.*
2. Cerebral disease is not commonly attended by high-marked exaggeration of function, such as furious delirium, convulsions, intense hyperæsthesia, pain, or tenderness.	2. The subsequent diminution or loss of nervous function which succeeds the prolonged existence of "head symptoms" is generally preceded, in cases of meningeal disease, by extremely severe excitement or exaggeration of functions, such as pain, tenderness, furious delirium, or convulsions.
3. Little vascular excitement attends cerebral disease, nor is there frequently any highly marked general disturbance.	3. In meningeal affections there is usually much local vascular excitement, with general disturbance.
4. Paralysis and Anæsthesia, losses of Volition, Ideation, Perception, and the like, characterize cerebral disease.	4. Spasms, convulsions, pain, and delirium, are the general features of meningeal disease.

In diagnosing the locality of diseases of the brain generally, it is necessary to distinguish, in the first instance, the *intrinsic diseases* of the nervous system, which properly constitute the order *cephalici;* also local diseases from nervous complications of other diseases not of a local kind. It is necessary also to distinguish affections of the *brain, spinal cord,* and *nerves,* as much as possible from each other; and, lastly, to separate diseases of the *meninges* from *cerebral lesions.*

It is chiefly by the history of the case that nervous symptoms peculiar to the *Specific* or Constitutional class of diseases are to be distinguished. It is also generally worthy of notice that symptoms referable to altered nervous functions are the earliest indications of intrinsic or local diseases of the organs of the nervous system; and that when general disease exists of a Specific or Constitutional kind, the nervous symptoms are secondary in relation to the time of their appearance, compared with the earliest manifestation of symptoms of ill-health.

The diagnostic value of *vomiting,* as a symptom of cerebral disease, is one which must be thoroughly appreciated. Regarding this symptom, Dr. Reynolds makes the following remarks:—"The intimate sympathy" subsisting between the stomach and the head

is a matter of daily observation. Headache from gastric disturbance is as common as vomiting from cerebral derangement. In children especially, the existence of obstinate vomiting is indicative of head rather than of stomach disease. A consideration of the following points (for comparison tabulated) may lead to the discrimination of the pathological significance of this symptom:—

GASTRIC OR HEPATIC VOMITING.	CEREBRAL VOMITING.
1. There is nausea, which is relieved, at all events temporarily, by the discharge.	1. Little or no nausea, and the vomiting continues, in spite of the complete discharge of its contents by the stomach, so soon as anything (liquid or solid) is introduced.
2. The tongue is foul, the conjunctivæ often yellowish, and the headache secondary in respect of time.	2. The tongue may be clean, the conjunctivæ colourless or injected, and the headache primary.
3. Griping pain in the abdomen, diarrhœa, and disordered evacuations frequently attend the *gastric* or *hepatic vomiting*.	3. Obstinate constipation generally attends *cerebral* vomiting.
4. Retching and increased salivation attend *gastric* or *hepatic vomiting*.	4. In *cerebral* vomiting the stomach is emptied almost without effort, and without any increase of the salivary secretion.

Thus, while vomiting may depend upon derangement in the gastro-intestinal canal, it may also depend upon increased sensory or reflex action, and is thus a valuable indication of cerebral disease.

2. **As to the Nature of the Affection.**—The nature of the intrinsic diseases of this order may be shortly stated to be—

I. *Acute*, but *non-febrile*, to distinguish them from the nervous symptoms which attend the febrile state of many of the diseases already noticed, as peculiar to the *Specific* and Constitutional classes. They are of such a kind as are marked by—(1.) Diminution or loss of functional activity (apoplectic and paralytic diseases); (2.) Increase or excess of action, such as of sensibility (neuralgia), of mobility (convulsions, spasms), ideation (delirium).

II. *Chronic* diseases, the character of chronicity depending not only on the time such diseases last, but also on the severity of their course.

Such chronic diseases are marked by—1. Excessive functional

activity, as by *neuralgia, hallucination, chorea, hypochondriasis.* 2. Diminution or loss of functional activity—for example, *anæsthesia, paralysis, dementia, epilepsy.* 3. Combinations of these conditions, such as—(1.) Loss of mobility, with increased sensibility, as in *paralysis with pain.* (2.) Loss of mental, with increased motor activity, as in *coma* with spasms. (3.) Loss of sensibility, with increased mobility, as in *anæsthesia* with *reflex spasms.*

It is of great importance to recognize, as Dr. Brown-Séquard points out, the necessity of distinguishing between the symptoms of—(1.) Loss of function; and (2.) Irritation.

Symptoms of irritation may be arranged in two groups, according as the irritation acts—(*a.*) In the central parts, as in convalescence from such serious illnesses as typhoid fever—overtaxing the mental powers, as in the case of weak children; or, (*b.*) In the peripheral parts of nerve-fibres, as in the neuralgic headache of dyspeptic children during the second dentition, when the symptoms frequently resemble those of the first stage of *tubercular meningitis.* Convulsions are not rarely due to the irritation of ascarides; and they also occur concomitantly with the second dentition, just as they occur in the first.

The most frequent cause of local paralysis or loss of function is an irritation in certain parts of the nervous centres, or in the trunk or periphery of nerves. Such circumstances may produce paralysis in very different parts in different cases, according to the particular fibres on which the irritation has acted. Thus there are now numerous cases, capable of clinical recognition, where paralysis of the upper and lower limbs, and of the face, as well as of contractions and rigidity, which are traceable to the influence of reflex action.

3. **As to the Anatomical Condition.** — Although some of the diseases of this order are marked by excessive severity of symptoms during life, such as *tetanus, epilepsy, chorea, hysteria, neuralgia,* and the like, yet no characteristic or constant structural change can be detected in the nervous centres after death, either as a consequence or as a cause of such diseases; and although the belief is daily extending, that no morbid conditions of function can exist without some correspondent change in the organs, yet, so long as we have no means of appreciating such changes, the diseases now noticed must be regarded as "neuroses,"

"dynamic," or "functional" diseases. But there are many other diseases of this order which are attended by some physical changes in the organ, expressed by undoubted symptoms during life, and which leave evidence of their existence after death. For example, very different apparent vascularity is discoverable after death in the nervous masses and texture; and there are two very common classes of nervous symptoms during life which evidently depend upon the variable amount of blood in the brain. These symptoms are referable to *active arterial hyperæmia*, and are distinguished by the well-known phrase of "determination of blood to the head;" or they are referable to *passive venous hyperæmia*, commonly called "congestion." The question has been much discussed and experimented on as to whether more than a fixed proportion of blood can find its way into the brain; and there can be no doubt that all considerations of the subject lead to the conclusion that the quantity of blood within the cranium is extremely variable at different times and under different circumstances; and (as clearly stated by Dr. Sieveking) there is a peculiar property belonging to the white matter of the brain which has a strong bearing on the question—namely, the great elasticity of the medullary tissue, so much so that the resiliency afforded by this property is a sufficient counterpoise to the rigid structures which envelop the brain, and which do not, as is erroneously supposed by some, remove the intracranial contents entirely from the influence of atmospheric pressure. That pressure is exerted on a large surface, composed of columns or tubes of blood in innumerable small curved vessels which maintain, through the scalp and diploe of the skull, a direct communication with the blood within the cranium; and which is thus directly influenced by atmospheric pressure, while every anatomical arrangement of the parts within the cavity of the skull illustrates provisions made to counterbalance the varying interchange of bulk between the solid and fluid contents of that cavity. Among these may be noticed the ventricular and subarachnoid spaces, with their varying amount of contained serosity, as furnishing most prominent evidence of provision to accommodate the varying amount of fluids within the cranium.

Morbid states of the brain are also due to a poisoned state of the blood; although such a condition cannot be proved in all cases,—such, for example, as occurs in many of the zymotic and

constitutional diseases already noticed ("Typhus," "Variola," "Rheumatism," "Alcoholism," "Narcotism," "Blood Poisoning by Urea").

Urea in the Blood and Brain.—It is often of importance to determine whether urea circulating in the blood is contaminating the brain and impairing its functions.

The following instructions are given for the detection of urea in the brain after death, as well as for its discovery in the blood during life:—

"1. *In the Serum.*—Take the serum from a good-sized blister, and evaporate it to dryness over a water-bath. The residue is to be extracted with alcohol, which is a ready solvent of urea. This alcoholic extract is then to be evaporated to dryness, and a little water added, so as to

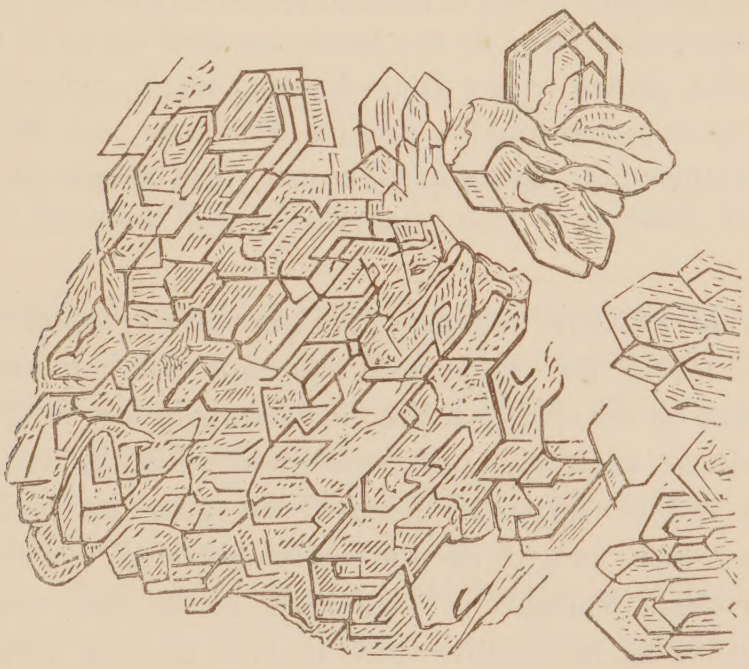

Fig. 4.*

make a syrupy mass, which should be plunged into a freezing mixture, and a few drops of pure nitric acid added to it. If urea be present, the characteristic crystals of nitrate of urea are soon found in the solution, and may be recognized either by the naked eye or by the microscope (fig. 4).

"2. *In the Substance of the Brain.*—Take about three-fourths of a whole brain, and cut it up into small pieces. Then treat it with four successive portions of boiling distilled water, each portion, consisting of about ten ounces, being allowed to stand six or eight hours before the next is added. The brain while thus macerating should be frequently

* Nitrate of Urea (after BEALE). No. II. Urinary Deposits, Plate III.

stirred and mashed about with a glass rod. The washings, after being poured off, are to be mixed together and filtered. The filtered aqueous extract so obtained must be evaporated to dryness over a water-bath, and the dry residue, after being powdered, is to be again treated with four successive portions of boiling distilled water, observing the same precautions as before. The washings, after being mixed together as before, are to be filtered, and the clear solution evaporated to dryness over a water-bath; and after being thoroughly dried in a hot water oven, the residue obtained in this manner should be finely powdered, and the powder boiled in five successive portions of ether. The ethereal extract so obtained should be evaporated to dryness at a low temperature, and then treated with a little tepid water, and allowed to get quite cold. It is then to be filtered through paper previously moistened with water, and the clear solution again evaporated to dryness at a low temperature, when a small quantity of the extract procured in this way (which would contain all the urea present in the brain operated upon) is to be placed on a glass slide, treated with a drop of strong nitric acid, covered with a bit of thin glass, and allowed to stand a little time, and then examined under the microscope. A few crystals will then be seen, having all the characters of those of nitrate of urea" (*Clinical Lectures*, by Dr. Todd, 1859).

The Morbid Textural Changes of the brain consist chiefly of inflammation and its *productive* consequences, or in softening, degeneration, or atrophy of the nerve-substance; and in heterologous products, such as result from *tuberculous* or *carcinomatous* infiltration. The nervous centres are also known to waste, harden, and lose weight as age advances, and the nerves participate in these changes. Hardening seems less constant than wasting and loss of weight; but it is a change very generally observed in old people; and its characters are thus described by Dr. Maclachlan: "The cortical portion is thinner and darker than in adults, and the medullary portion is often void of its glistening white appearance, which gives place to a dull white or grey, and frequently to a pale drab colour in old age." The membranes of the brain are also thicker, more opaque, and more resisting in the aged. This is especially the case with the arachnoid, and is associated with enlargement of the Pacchionian glands or villi. The condensed dura mater acquires immense strength, and adheres firmly to the calvarium, especially along the margins of the longitudinal sinus.

When the brain shrinks, as in atrophy, there is a marked

increase in the cephalo-rachidian fluid, according to the degree of atrophy. Instead of two or three ounces, there may be ten or twelve ounces; and the subarachnoid areolar tissue is then also frequently infiltrated with serum (MACLACHLAN). The ventricles contain more than the usual quantity of serosity, and the lateral ventricles especially are filled with limpid fluid. Flattening of the surface of the convolutions becomes apparent, while the sulci are widened and diminished in depth.

It is of importance to study every disease of the nervous system as presenting—(1.) Disease or changes in tissues; (2.) Damage of organs generally; (3.) Disorder of function (H. JACKSON).

CHAPTER IV.

MEANINGS OF SOME WORDS IN COMMON USE IN DESCRIBING BRAIN DISEASES.

Convulsion.—The occurrence of universal involuntary muscular contraction, generally of paroxysmal or temporary duration.

Spasm.—Involuntary convulsive actions of less extent. Of these there are several varieties:—

(*a.*) *Clonic Spasm*—Consists in rapidly alternating contraction and relaxation, as in *subsultus tendinum.*

(*b.*) *Tonic Spasms* or *Spastic Contractions*—Consist in contractions having a certain duration, attended with rigidity or hardness of the muscles, as in *common cramps* and *tetanus.*

Epileptoid or *Epileptiform Attacks*—Imply a sudden loss of Perception and voluntary power, with more or less generally distributed spasmodic movement. The movements are quasi-tonic at first, then clonic, and appear to impede the respiratory process. The attack lasts from two to twenty minutes, followed by some exhaustion and sleep (REYNOLDS).

Coma—Denotes the loss of Perception and Volition; in other words, the loss of Consciousness, with the appearance of profound sleep, from which the patient may be partially roused.

CHAPTER V.

DETAILED DESCRIPTION OF DISEASES OF THE NERVOUS SYSTEM.

SECTION I.—CEPHALIC DISEASES, ATTENDED WITH A FEBRILE STATE.

MENINGITIS.

LATIN, *Meningitis;* FRENCH, *Méningite;* GERMAN, *Gehirnhautentzündung* —Syn., *Meningitis;* ITALIAN, *Meningitide.*

Definition.—*A complex morbid state of the immediate coverings of the brain, attended with more or less vascularity of the membranes, opacity of the arachnoid, and the formation of adventitious products between the arachnoid and the pia mater, and the effusion of serum or of pus in the same situation. Acute pain in the head, from the first, accompanies the development of these lesions, attended with intolerance of light and sound; watchfulness, delirium, flushed countenance, and redness of the conjunctivæ, or a heavy, suffused state of the eyes; quick pulse, frequent spasmodic twitchings or convulsions, passing into somnolency, coma, and complete relaxation of the limbs* (COPLAND).

Pathology.—This morbid state is properly known as "*Meningitis.*" It may be simple and idiopathic, or it may supervene as the result of some Specific or Constitutional disease, such as of some of the fevers, or of the syphilitic, rheumatic, gouty, rachitic, or scrofulous cachexia. Three several forms (in addition to the general involvement of all) may be distinguished.

(1.) Inflammation of the *dura mater.* This is almost invariably the result of injury or disease of the bones of the skull; and in such cases the injury or disease by which it is caused may be readily distinguished.

(2.) Inflammation of the *pia mater* and *arachnoid.* In diffuse *arachnitis* the arachnoid has seldom any considerable redness or congestion, but is thickened and opaque; while the transparent serum naturally contained in the cavity of the arachnoid being now scanty, or wholly wanting, it has neither that polish nor that moisture which is natural to it in health, so that it appears brown and dry. The principal phenomena of *arachnitis* are most obvious in the *pia mater,* so that the large vessels of that

membrane are greatly congested; but still, according to Dr. Baillie, the redness is not so general nor so continuous as in inflammation of other serous membranes. Also, if the *pia mater* be attempted to be removed, it is easily torn, and separates from the brain in small fragments. The arachnoid covering the *dura mater* seldom participates in this affection. These are the appearances observed in diffuse *arachnitis*, supposing it to terminate by resolution. The inflammation, however, often proceeds, and may terminate by effusion of serum, lymph, or pus.

When serum is effused into the arachnoid cavity, the opacity of the arachnoid gives the serum a gelatiniform appearance; but when that membrane is divided, the serum is found to be fluid, and to diffuse itself in every direction; sometimes, however, it may be turbid, from an admixture of a small portion of free albumen. It is also not unusual to find a few points of lymph, of pus, or of blood, either at the exterior surface or within the arachnoid, effused along with the serum, and almost in juxtaposition with each other. The quantity of fluid effused is variable,—from two to three drachms to as many ounces. The effusion most commonly takes place at the upper surface of the hemisphere, but sometimes at the base, and sometimes into the ventricle of the brain. Lymph is the form which the exudation usually assumes ultimately if life continues, varying in density and thickness, dipping down between the convolutions; and commonly it is most abundant on the upper portions of the hemispheres. Foville says he has met with cases in which the effused lymph covered the whole of the brain, or nearly so, as far as the *tentorium*. The lymph was deposited in the arachnoid sac in two layers—one adherent to the cranial arachnoid, and the other to the cerebral arachnoid; while between them was a stratum of serum. He mentions having had six cases of this description under his care for several years, and that they were all in a state of the dullest stupidity, and apparently labouring under paralysis of every sense. They were like statues, with this difference, that, placed upright, they preserved their balance; if pushed, they walked; and if food was placed in their mouths, they swallowed it (Art. "Méningite," p. 406, *Dict. de Médecine*). Lymph also may be effused into the arachnoid cavity, but it is generally in small quantity.

Suppurative inflammation may take place either into the

subarachnoid spaces or into the arachnoid sac. It is, however, by no means a frequent occurrence. Rostan gives several cases of effusion of pus into the arachnoid cavity, likewise Morgagni, Cruveilhier, and Dr. Bright. Dr. Baillie states that he once saw pus effused into the cavity to such an amount as to cover the entire upper surface of the brain. Two cases are given by Dr. Hodgkin of cut wounds of the head in which pus was found in the arachnoid sac. Dr. Sieveking relates a remarkable instance of purulent exudation of the arachnoid, occurring in a young woman aged twenty-seven, under his care, at St. Mary's Hospital, in whom sudden and unexpected coma supervened, and terminated, after thirty-six hours, in death. She had previously suffered from *otorrhœa;* but on her admission she gave no signs of cephalic disease; nor was any direct connection traced after death between the affection of the ear and the *meningitis.*

The characters of *chronic arachnitis* are—a similar opacity and thickening of the membranes, together with granulations of a pearly colour, and more especially along the longitudinal sinus, and also an augmentation of the *glandulæ Pacchioni.* Much serum is effused into the cavity; and the connective tissue by which the pia mater is attached to the brain acquires considerable strength, so that portions of the brain come away with the membranes. The membranes acquire considerable tenacity; and so marked are their characters in some cases, that Dr. Maclachlan notices an instance in which a portion of the arachnoid nearly an inch square was fully an inch thick, in appearance like the boiled white of an egg, and equal to the peritoneum in toughness. The surface of the brain is pale, and sometimes slightly atrophied. Much serum abounds in the arachnoid cavity, in proportion generally to the atrophy of the brain; and the ventricles contain serum (MACLACHLAN). Ossification of the pia mater is extremely rare; but it also becomes thickened, opaque, and injected. Dr. Baillie, however, mentions one case of ossified pia mater, on the authority of Soëmmering; and Dr. Hodgkin speaks of a specimen in the museum of Guy's Hospital.

In *acute arachnitis of the ventricles* the membrane becomes thickened, semi-transparent, pulpy, and sometimes sprinkled with minute spots of blood. It is rare to find lymph effused, but occasionally old adhesions are seen between the opposite surfaces of the ventricle. Pus has also been occasionally found in these

cavities. With regard to the effusion occurring in the ventricles in "*meningitis*," it is correctly remarked by Dr. Sieveking that "it offers many relations different from the arachnoidal effusions occurring on the surface of the brain; nor is it quite intelligible why the secretion into the cavity of the ventricles should so rarely be found to communicate with the superficial arachnoidal space." The anatomical relation of these parts may in some measure explain the differences; for it is very doubtful that the arachnoid lines the ventricles of the brain, an arrangement which Kölliker considers impossible. Nevertheless, there is in meningitis generally an increase in the ordinary amount of the fluid in the ventricles, to the extent of several drachms, which may perhaps be regarded rather as a result of contiguous sympathetic effusion than as an extension by continuity of the inflammatory exudation.

A microscopic examination of the smaller vessels of the pia mater in *meningitis* shows that they are studded with the exudation-corpuscles described by Gluge and Bennett, and with oily-like vesicles; and these appearances are found both within and without the vessels (SIEVEKING).

(3.) *Tubercular meningitis*—Syn., *Acute hydrocephalus*. The *meningitis* which accompanies the cachexia associated with *tuberculosis* is of a very distinctive kind, and frequently terminates the lives of tuberculous children. Its essential morbid character consists in the growth of tubercle on the arachnoid, generally in the shape of small miliary granules, resembling in appearance the Pacchionian bodies, but differing from them in minute structure and in position. They are found most frequently and most abundantly within the fissure of Sylvius, between and upon the convolutions of the brain, and at the base of the brain, and very rarely on the cerebellum. They are generally of the nature of the grey granulations imbedded in the vascular network of the pia mater. Meningitis is also apt to occur as the result of *gout* or of *rheumatism*, constituting *gouty* or *rheumatic meningitis* (MACLACHLAN); and it is an occasional if not a frequent consequence of Bright's disease (CHAMBERS, GOODFELLOW, MACLACHLAN).

Causes.—Every age is liable to meningitis. Children are often attacked by it whilst teething, under the form described as *hydrocephalus acutus*, and also when labouring under *scarla-*

tina, measles, or other disease caused by a specific poison. Adult age, as well as the middle periods of life, is still more liable to this affection, both from the greater exposure to the action of the typhus, typhoid, and paludal poisons, to syphilis and to mechanical injuries, as well as to the greater intemperance and greater excitement incident to this age. In old people meningitis is likewise common; and two forms of the disease are met with in the aged,—namely, the *acute* and the *chronic,* both of which present great varieties in their character and progress (MACLACHLAN), and both sexes perhaps suffer in nearly equal proportions.

Meningitis, however, is a disease which most commonly occurs from the action of some specific morbid poison; and there are few agents of that class which are not apt to act on the membranes of the brain. There are many instances also of persons suffering from *arachnitis* after exposure to the heat of the sun, or to what is in common language called the "*coup de soleil,*" and which will be considered under the head of *insolatio.* Intemperance, as well as great mental work and anxiety, is also a frequent cause of the chronic forms of the disease; but the free use of alcoholic liquors is perhaps the most common predisposing cause; while fits of intemperance occasionally are the direct agents which induce the disease. It is especially apt to be associated with or to follow *delirium tremens* in the aged, and likewise *gout* or *rheumatism.* It is also especially connected with *insanity,* and with every structural disease of the brain; and to these causes must be added mechanical injuries, diseases of the bones, and morbid growths, especially in cases of primary implication of the *dura mater.*

Symptoms and Diagnosis.—*Meningitis* has usually been described in three stages. The symptoms of the first stage are those of excitement, resulting from diffuse inflammation. The symptoms of the second stage are those of compression, marking that effusion has taken place; while those of the third stage are associated with progressive recovery, or with the modes in which death may occur.

But there are symptoms characteristic of several forms of this disease, which may be classed as follow:—

(*a.*) *Simple Meningitis.*—The type of this morbid condition is that in which the membranes covering the convexity of the hemispheres are the parts generally affected. The most important

facts to be ascertained in the previous history of the case, before the development of cephalic symptoms, relate to the general health, and especially to any signs of cachexia or diathetic states, such as *tuberculosis, rheumatism, gout,* or of the specific action of implanted poisons, such as *syphilis.* It is important also to ascertain whether any blow on the head has been sustained, or if the patient has been much exposed to the sun; whether any disease of the ear or nose exists; whether application to study has been intense, or to the cares of business.

Premonitory symptoms may be trifling, or absent altogether. The most common are slight but increasing pains of the head, sensorial disturbance, irritability of temper, or restlessness, with some general *malaise.* Rigors quickly supervene, or simple chilliness, with *cutis anserina* and pallor of the surface, quickly followed by febrile re-action. An attack of convulsions may supplant the rigors, especially in children. Such, however, are by no means common in the adult, and are not necessarily indicative of any severe or advanced lesion. The fever is commonly high; the pulse sharp, hard, and frequent; the respirations are irregular, performed with a sigh, and often with a moan. The skin is hot; the bowels obstinately constipated; and evacuations, when they occur, are dark and offensive. In this stage there is little or no prostration of strength. The headache of fever is supplanted by acute and intense pain; the face flushes and turns pale alternately; the eyeballs stare, and the conjunctivæ become injected.

The purely nervous symptoms, expressed by *mental, sensorial,* and *motorial* phenomena, are thus classified by Dr. Reynolds:—

1. *Mental.*—The temper is extremely irritable. There is marked somnolence, or wakefulness, and the two sometimes alternate for several days. The most marked feature is delirium, commencing early, and of a furious character, the patient screaming and gesticulating in the wildest manner; the expression of countenance is savage and malignant, or sometimes has the fierce aspect of the brute.

2. *Sensorial.*—Marked and continuous headache (*cephalalgia*) prevails, with exacerbations of a darting, violent character, eliciting from the patient, and especially from children, a sharp, piercing cry. Pain is increased by movement, and the patient holds the head with the hands; or, if a child, frequently carries

them to the head. The headache is increased by sensorial impressions, and hence the eyes are obstinately closed, and the ears, if possible, kept covered with the bedclothes. Double vision, *tinnitus aurium*, *formicatio*, and subjective sensations of various kinds are present. The sensorial disturbances are highly marked.

3. *Motorial.*—Restlessness is incessant, sometimes general or partial. The muscles of the face and limbs twitch involuntarily. There is strabismus, or the eyeball is unsteady, and with a contracted or oscillating pupil. Vomiting is frequent, without epigastric pain or tenderness, and often without nausea.

This stage generally lasts from *one* to *four* days, and its characteristics may be shortly expressed as consisting of—*the combination of great nervous hyperaction, with marked fever, a peculiar cry, cephalalgia, vomiting, and constipation.*

The second stage is one of a transition from the first to the third. The fever diminishes. The pulse sinks in frequency and force, becoming variable in frequency between very wide limits, and in very short intervals of time. Respiration becomes peculiarly irregular. The bowels continue constipated. The tongue becomes furred and dry. The heat of the head persists, but the body generally is cool.

The nervous phenomena present remarkable intermissions during the further progress of the affection, especially in the following points:—

1. *Mental.*—Delirium becomes quieter, or passes into coma; or the patient may appear collected and well.

2. *Sensorial.*—Excitement diminishes and disappears, and drowsiness is the most common feature.

3. *Motorial.*—Muscular twitchings generally are increased on both sides of the body. Convulsions are common in the child, and spasms often alternate with paralysis. A violent general convulsion may throw the patient at once into

The third stage.—It may come on almost immediately, or a week of transition symptoms may intervene. The face becomes sunken, the extremities cold, and the abdomen retracted. *Sordes* form on the gums and teeth. The pulse flutters, becomes thready, feeble, and uncountable. Great prostration of strength supervenes.

The nervous functions are gradually suspended.

1. *Mental.*—Perception, Volition, and Ideation become lost, so far as can be ascertained by corporeal signs.

2. *Sensorial.*—Anæsthesia is complete.

3. *Motorial.*—There is absolute paralysis to almost every form of stimulus, observed first in the eyelids and eyeballs, and then in the limbs. Muscular relaxation becomes complete, as evidenced by the dilated pupil, stertorous breathing, involuntary micturition and defecation.

Generally there is absence of nervous action, and organic life gradually dies out.

The duration of these stages is various. For the most part each lasts a week; but one or more stages may be wanting.

The tongue in the first stage is white; in the second it becomes brown; in the third it again cleans, if the patient does not die. The pulse, likewise, in the first stage is from 90 to 100; in the second from 110 to 130; and in the last stage it either gradually returns to its natural standard, or runs on too rapidly and too feebly to be counted.

The symptoms which have been described are those which especially mark *arachnitis* at the superior portions of the brain. When, however, it occurs at the base, or in the ventricles, some differences are observable, although the condition cannot always be distinguished; but in some cases such a location of the malady is rendered probable if the Intellect is less impaired, the Passions more excited, and the patient lies fretful, impatient, morose, and, although somnolescent, he occasionally cries out and grinds his teeth very early in the disease; while the parallelism of the axis of the eye is frequently affected at an early period.

(*b.*) *Tubercular Meningitis in the Child.*—It is an object to ascertain the existence of the scrofulous cachexia in the first instance, as described at page 206, *ante, et seq.* If such exists, *tubercular meningitis* may supervene on the occurrence of any febrile disturbance, with slight thirst and anorexia; irregular and somewhat quick pulse; vomiting and constipation; clayey evacuations deficient in bile; red and moist tongue; dry and hot skin, and other phenomena of general derangement. The temperature, as measured by the thermometer, will be found to be persistently above the normal amount (RINGER).

The special nervous phenomena are often feebly marked.

1. *Mental.*—There may be irritability of temper and peevishness, with some slight delirium at night, rarely commencing early in the disease, disturbed sleep and restless manner.

2. *Sensorial.*—Pain in the head prevails, with intolerance of light and sound. Vertigo is also indicated by staggering, or clinging to objects for support.

3. *Motorial.*—Grinding of the teeth prevails, occasional vomiting, unsteady, restless movements, and dragging of the limbs. After three or four days of these premonitory symptoms,

The second stage commences, with heat of head and flushings of the face, alternating with pallor. The pulse is irregular, and commonly, when the child is still, it is of little frequency, but rises rapidly if the child is disturbed. The vomiting ceases, but the constipation persists, with retracted abdomen.

The following special nervous phenomena become more marked:—

1. *Mental.*—The child inclines to lie quiet, and resists being moved, as if pain was increased by motion. There is delirium, which is sometimes fugitive and sometimes persistent.

2. *Sensorial.*—The cephalalgia increases. The expression of countenance bespeaks great suffering, and the face looks aged. A peculiar piercing cry is now and again given by the child. The eyes are closed, and there is a tendency to drowsiness.

3. *Motorial.*—Strabismus and muscular twitchings occur. The pupils are variable, and often oscillate, and the eyeballs are unsteady.

The third stage of tubercular meningitis is ushered in by the general symptoms of approaching dissolution, such as coldness of the extremities, clammy perspiration, and an excessively rapid but feeble pulse.

The special nervous phenomena are first those of exalted spinal action, and then those of general prostration.

1. *Mental.*—Drowsiness passes into stupor, with an idiotic expression of face. There is loss of Perception and Volition.

2. *Sensorial.*—All signs of activity give place to anæsthesia, and the eyes are half open.

3. *Motorial.*—Death approaches by convulsions, with partial paralysis, *subsultus-tendinum,* clenched hands, retracted head, and automatic movements, giving way to general relaxation.

(*c.*) *Tubercular Meningitis in the Adult.*—The symptoms occasionally assume an apoplectic, sometimes a convulsive form, at the commencement; and the febrile character is generally imperfectly marked. The premonitory symptoms are those associated

with the scrofulous cachexia, and *meningitis* may occur at any stage of the lung disease. The following are its features:—

After some remission of chest symptoms, special nervous phenomena referable to the head may supervene.

1. *Mental.*—The patient looks bewildered, with a dull, heavy, expressionless face, often highly characteristic. There also appears to be some *intellectual* incapacity to speak; the patient, seeming to understand what is said or asked, looks at the inquirer for a few seconds, and then turns the head away without a reply. There is often marked somnolence.

2. *Sensorial.*—Pain in the head, fixed to one spot (generally the forehead), is the most striking symptom, of considerable intensity, and is persistent for many days.

3. *Motorial.*—An attack of convulsions may precede every other symptom, but paralysis is rare.

The second stage is of very variable duration, the pulse is highly irregular, while alternate flushings and pallor of the countenance are common, and all the symptoms already noticed become more intense, mild delirium prevails, and the face becomes increasingly stupid-looking.

Paralysis of volition alternates or co-exists with clonic or tonic spasms, strabismus, or prolonged convulsive attacks.

The third stage of tubercular meningitis in the adult is marked by increasing stupor, immobility, and involuntary defecation and micturition.

The general characteristics of *tubercular meningitis* thus consist in the occurrence of fixed pain, vomiting, dulness of Intellect, and duskiness of the face, with partial paralysis or convulsions, slight fever, and diminution of the chest symptoms in a patient demonstrably tuberculous. The indications of inflammatory action are only feebly marked, not only during life, but after death; and very often the febrile state which had existed before becomes less noticeable at the onset of cerebral symptoms. Still, heat of head, injected conjunctivæ, and flush of face denote a condition of vascular excitement; while persistent headache with febrile symptoms in a patient otherwise phthisical, when it can be traced to no other known cause, is strong presumptive evidence of impending *tuberculous meningitis* (Hill). The aid of the thermometer should invariably be sought in diagnosis, (see p. 42, vol. i.) But there are also cases in which the disease

of the brain is marked by the absence of ordinary symptoms. The premonitory phenomena already noticed, for example, may be absent, especially in children; and then the steady persistence of any one symptom becomes of great importance in diagnosis—for example, sickness, headache, constipation, drowsiness, heat of head (WEST).

(*d.*) *Acute Meningitis of the Aged.*—Dr. Maclachlan gives the best account of this form, and the phenomena he describes may be classified as the previously described forms have been. It seldom occurs suddenly, nor with the intense symptoms which prevail in the meningitis of early manhood. It commences insidiously, without rigors, and very frequently some days elapse before it can be recognized, even by persons familiar with the diseases of old age. The pulse is natural, the tongue remains clean, the bowels regular, and there is little or no vascular excitement, local or general, but the symptoms at the outset are purely of a nervous character.

1. *Mental.*—The temper is peevish or irritable, with more or less confusion of thought, inattention, and forgetfulness. "If infirm, and already an inmate of an hospital, the patient commits strange mistakes, takes possession of another's bed, uses the spitoon instead of the chamber-pot, and is frequently found lying outside the clothes, or with his feet where his head ought to be. When addressed, his answers are rational, but still there is a peculiarity in his manner and expression of countenance, an apparent slowness of comprehension, and a vacancy of the eye, that warns the Physician of the approach of some cerebral disease" (*The Diseases and Infirmities of Advanced Life*, p. 85).

2. *Sensorial.*—The appetite is slightly if at all impaired; and the skin remains of normal temperature.

3. *Motorial.*—Restlessness prevails, although prostration is apparent. In walking the gait is unsteady, and in lifting anything to the mouth the hand trembles. In a few rare cases the disease commences with convulsions.

While such symptoms are being developed, after twelve, forty-eight, or sixty-two hours, but generally within twenty-four hours, more or less febrile re-action is expressed by slight increase of temperature merely, and without any marked redness of the face or acceleration of the pulse. The nervous symptoms are now of the following kind:—

1. *Mental.*—Wandering, low muttering delirium and incessant

talking become frequent and characteristic symptoms. Maniacal excitement is uncommon. For a day or two the patient may answer questions rationally, though slowly and hesitatingly, when roused from the reverie in which he is generally wrapped. At a still more advanced stage there is coma.

2. *Sensorial.*—Headache is not a prominent symptom. It is so slight or unfrequent that unless the patient is pointedly asked the question, there is never any allusion either to it or to giddiness, or to *tinnitus aurium.* This absence of headache is pointedly noticed by Dr. Maclachlan as a remarkable character; for even in the most acute pus-forming or false-membrane-forming meningitis, headache may be entirely absent from the beginning. The eyes are suffused, the pupils either slightly contracted or natural. Knitting of the eyebrows, intolerance of light, acuteness of hearing, and vomiting,—common and characteristic phenomena of the disease in early life,—are comparatively rare in the aged. The scalp may be hotter than natural, and, combined with the suffusion and injection of the eyes, is the only physical indication present of vascular excitement within the cranium. The feet are frequently cold, and the surface generally moderately warm. There is usually great thirst, the patient drinks greedily, but seldom asks for liquid. He is apt to refuse food, or takes but a small quantity at a time, when it is presented to him.

3. *Motorial.*—Nervous twitchings and convulsions are observed in the worst cases; and if the patient be raised in bed, these symptoms are frequently induced when otherwise absent, and the head trembles, as well as the upper extremities. When coma prevails, there may be sometimes slight convulsions of the limbs.

The general features of the disease resemble typhus fever. The tongue becomes very dry, and generally brown in the centre. The bowels cease to act without medicine, but are not obstinately confined. Towards evening there is generally increased febrile disturbance, denoted by flushing of the face, where it had been previously pale and dejected; dryness of the skin, greater heat of the scalp, and acceleration of the pulse. In numerous examples, while dulness of Intellect and somnolence are the first symptoms observed, in others great and unusual loquacity, with redness of the face and heat of the scalp, ushers in the disease. The progress of the disease is equally inconstant. In not a few cases the symptoms of febrile excitement are wanting; but dulness of Intel-

lect and stupor, with more or less insensibility of the limbs and relaxation of the sphincters, are frequently prominent symptoms throughout the whole course of the disease, as if the medullary substance of the brain were congested or suffered compression from early exudation on its surface. Such examples of an apoplectic character are more frequently met with in old persons addicted to fermented liquors, in whom the cerebral vessels are enlarged from repeated engorgement. Excessive venous congestion of the brain prevails in such cases during life; and the symptoms of meningitis are marked, and apt to be confounded with effusion into the brain, or softening of its texture (MACLACHLAN, l. c., p. 87).

(*e.*) *Chronic Meningitis of the Aged* is extremely subdued in its symptoms and insidious in its approach. It is not unfrequent as a result of albuminuria, or of repeated attacks of *delirium tremens;* or it follows *gout* or *rheumatism.* The characteristic phenomena may be arranged as follows:—

1. *Mental.*—It is almost uniformly accompanied with great impairment of the mental faculties. There is very marked loss of Memory, slowness of comprehension, periodical fits of passion.

2. *Sensorial.*—Vertigo prevails, with ringing in the ears; and occasional attacks of headache occur, with or without vascular excitement.

3. *Motorial.*—Speech is thick. There is paralytic weakness of the lower limbs, and the gait becomes tottering and feeble. All movements, whether of the upper or the lower limbs, are performed slowly, awkwardly, and with more or less of uncertainty.

The energies of the whole system are reduced. The functions of organic life are impaired. The appetite may be good, but digestion is slow, the bowels being inactive, and the various secretions vitiated or diminished. "Sooner or later the aged invalid takes to bed reluctantly. There he lies uncomplaining, vegetating, the mere wreck of what he formerly was, both in mind and body, gradually sinking, and dying often in consequence of sloughing of the hips and nates" (MACLACHLAN, l. c., p. 93).

Diagnosis.—*Meningitis* is distinguished from *encephalitis* by the headache, the early delirium, and by the general absence of hemiplegia. It must be admitted, however, that disease of the brain and of its membranes is often conjoined, so that *meningitis* is not in all cases a simple affection, but is ultimately conjoined

with *cerebritis*, the inflammation of the membranes usually extending to the cortical portion of the brain.

From *delirium tremens*, meningitis is mainly distinguished by the character and mode of accession of the delirium, and the tremor, and by the *mental*, *sensorial*, and *motorial* phenomena.

From *typhus fever* it is mainly distinguished by the absence of the characteristic eruption or mulberry rash (see vol. i., p. 431).

Treatment.—As a general principle, remedies have little influence over those forms of the disease which arise during the progress of any Specific or Constitutional disease, independent of the general treatment indicated for that disease. When arachnitis arises from mechanical injuries, the treatment is generally by bleeding, active purgatives, especially by calomel and scammony, and by cold applications to the head. In chronic cases Foville strongly recommends the cold *douche*, but with caution, as being a powerful depressant, yet producing less ultimate debility than bleeding. It acts, doubtless, by cooling down the general mass of the blood. (See remarks under the treatment of "Hydrocephalus.")

In advanced life it rarely happens that the symptoms are so intense as to demand general blood-letting; but in vigorous constitutions this measure is sometimes necessary. Dr. Maclachlan gives a well-marked instance of its usefulness (l. c., p. 90). The cases which demand it are those attended by high cerebral excitement and vascular action. But as a rule local blood-letting is not only infinitely more safe but more beneficial, and it can be repeated from time to time, as the nature of the symptoms may indicate; while general blood-letting can very rarely be resorted to more than once, and that only at the commencement of the attack. The beneficial effects of local blood-letting may be greatly aided by keeping the head well raised, and by the constant application of cold water to the scalp; or the occasional use of bladders filled with crushed ice.

The bowels should be opened as rapidly as possible, unless the patient is feeble, emaciated, or greatly exhausted. Four or five grains of the *compound extract of colocynth* should be given, combined with two or three grains of calomel, in cases uncomplicated with *gout* or Bright's disease, and followed in a few hours with a dose of salts and senna. A fair proportion of nutriment must be given, in the form of milk, strong beef-tea, sago, tapioca,

or arrow-root; and the patient should be kept in a quiet and darkened room.

The more active symptoms being subdued, but not till then, a blister should be placed on the nape of the neck, if coma should ensue. The bowels should be kept open regularly, and the strength supported by mild unstimulating nutriment. When nervous irritability continues during convalescence, *henbane*, or *muriate* of *morphia* may be given (MACLACHLAN, l. c., p. 92).

In the *chronic* form the periodical attacks of headache or of insanity may generally be relieved by a brisk purge; and the head should be kept cool by cloths dipped in vinegar and cold water. If vascular excitement prevails, leeches may be applied behind the ears. The bladder must be kept empty of urine by the catheter, and although wine must be withheld during the active stage of the disease, it is beneficial when the vital energies begin to fail (MACLACHLAN).

The dietetic treatment should be strictly antiphlogistic, the patient especially avoiding all mental excitement; and, if not secluded, he should at least be kept tranquil, not only in body, but also in mind.

ENCEPHALITIS.

LATIN, *Encephalitis;* FRENCH, *Encéphalite;* GERMAN, *Gehirnentzündung* —Syn., *Encephalitis;* ITALIAN, *Encefalitide.*

Definition.—*A morbid state of the brain, more or less complex, according as it is general or local, or as it may or may not be combined with meningitis. The usual evidence of inflammation is shown by symptoms during life, and certain* post-mortem *appearances after death, such as dusky redness, softening or suppuration of some part of the brain-substance.*

Pathology and Morbid Anatomy.—The most general fact that has been determined regarding this morbid state is that there are two very distinct forms of *cerebritis* to be recognized both anatomically and clinically. While dissection demonstrates the fact that inflammation may exist either in the brain alone or in the membranes alone, yet clinically it is found that *meningitis* generally complicates *cerebritis*, and thus the phenomena proper to each of these morbid states become combined; and especially in that form of the disease in which the lesion is extensive, commonly known as "*general cerebritis*," "*phrenitis*," or "*ence-*

phalitis," when the precise seat of the inflammation cannot be determined except by post-mortem *examination.*

There are, however, more partial or local forms of this affection, to which the name of "*red softening,*" or "*acute ramollissement,*" has been applied; and which Gluge and Bennett, by the aid of microscopic observation after death, have learned us to regard as an inflammatory affection.

There are thus two states to be distinguished, namely,—(1.) "Inflammation of the brain-substance," with or without implication of the membranes, usually partial, and in many cases dependent on local injury or specific deposits or growths; (2.) Inflammatory red softening, or acute ramollissement, as contra-distinguished from "white softening of the cerebral substance," the result of an *atrophic* process and impaired nutrition.

The red *diffuse* inflammation of the substance of the brain appears to have many degrees. In the first degree the substance of the organ, when cut into, exhibits more bloody points than usual, so that the medullary portion appears as if sprinkled with blood, while the colour of the cortical substance is increased in intensity. If the inflammation assumes a higher degree, the most markedly red appearances generally only partially affect one of the convolutions of the brain, or a small portion of a hemisphere; and the inflamed part varies from a bright rose to a deep red dusky colour. This increase of colour is supposed by many pathologists not to arise from any greater vascularity of the part, but from blood escaping from the vessels and becoming effused or infiltrated into the substance of the brain, forming so many apoplectic spots (BOYER). The inflamed part is generally swollen, and sometimes considerably so, and is generally softer, though it may appear firmer than usual.

As the disease advances the exudation ultimately assumes the purulent character, or becomes more or less softened, approaching in character the condition of pus as it appears to the naked eye. Without suppuration, however, having actually taken place, the mere effect of inflammatory exudation amongst the brain-tissue is to soften its texture and increase its specific gravity, whereas in "white non-inflammatory softening of the brain" the specific gravity is diminished. When the softening results from the exudation merely, before it has undergone any subsequent change, there are traces of congestion, which give to the affected

part a red appearance; and the microscope shows, as Bennett first demonstrated, a large amount of exudation-corpuscles interspersed among the broken-down nerve-matter, as well as coating the inner and outer surface of the minute blood-vessels. Wherever exudation-matter exists, although there may be no palpable indication of changed consistence in the tissues, yet the specific gravity will be found increased; just as we find that without microscopic examination we cannot tell whether or not congestion of the brain-substance exists, combined with the exudation-corpuscles of red softening.

The inflammations of the substance of the brain have thus much in them that is peculiar, depending on the nature of the tissue; and, independent of physical appliances (such as the tests for specific gravity and the microscope), the unaided senses cannot enable us to appreciate the exact pathological significance of morbid changes. It is only in a small number of cases that the red colour of the brain is characteristic of inflammation; for in by far the greater number there is no increase of redness; and on account of the frequent occurrence of such cases, *ramollissement* has been described by many authors as a distinct idiopathic disease. The liberation of phosphoric acid and of fatty acids seems to be associated with yellow softening; and there is decided acid re-action of the fluid contained in the soft part (Rokitansky).

The varieties of softening, as characterized by their colour merely, cannot be regarded as essentially different: they are peculiarities due to the nature of the tissue and the effects of the morbid process upon its component parts. It appears to be the *liquor sanguinis*, rather than the *corpuscular* part of the blood, which takes the chief part in cerebral inflammations where softening is the prominent phenomenon. The characteristic of the part thus affected is, that it is generally whiter or greyer than the natural colour of the brain, and also softer than its natural substance; and, accordingly, a rough way to appreciate the presence of this softening is to allow a gentle stream of water to flow upon the suspected part; if softening exists, the softened parts will be gradually washed away. This softening, however, has many degrees, and in some cases can be only accurately determined by a microscopic examination. In its extreme form the softened portion of the brain is absolutely diffluent, so that it can be

poured out of the cranium with as much facility as a thickened cream or a thin jelly can be poured from one cup into another. Sometimes nearly a whole hemisphere has been thus destroyed (BRODIE, MACLACHLAN). In this semi-liquid state much serum can often be expressed from it.

Extreme softness of the brain, unattended with inflammatory coloration, may be well seen in those cases where the brain has been extensively injured, as by sabre wounds. Many such cases are related by our army surgeons. In cases of *hernia cerebri*, also, not only does the protruded portion become softened, with red particles of blood intermixed in it, but in acute cases, which terminate fatally in a few days after the injury, "the medullary structure, intervening between the base of the protruded part and the *anterior cornu* of the lateral ventricle, had entirely lost its natural structure, and become soft and pulpy. Around this disorganized mass, and extending across the *corpus callosum* into the medullary substance forming the roof of the opposite ventricle, the brain had undergone a change from its natural colour to a greyish-blue white, while it still retained its natural consistency" (STANLEY). It was remarked, also, in this case, during the last three days of life, that a very considerable quantity of fluid constantly oozed from the centre of the protrusion, whence it trickled down the cheek in a continued stream. Such cases show the acute and rapid nature of the softening process as an inflammatory phenomenon, but without any obvious discoloration. In fact, most of the phenomena connected with the inflammatory process in the nervous substance are characterized by the apparent want of increase of the red part of the blood.

Suppuration.—In the three forms of suppuration of the brain which are subsequently described, in by far the greater number of cases no trace of redness can be seen in any part of the brain; and probably this want of vascularity may account for the rare development of pus-corpuscles in the fluid of what appears to be abscesses, and which otherwise looks like pus. Pus is not always present in undeniable abscesses of the brain, but molecular granules, exudation-corpuscles, and pyoid bodies, evidently the result of the exudation-process, are generally the sole objects which the microscope can detect (LEBERT, BENNETT). Exudation in the softened state of the brain-substance, resembling pus, may be thus—(1.) Collected into the form of an abscess; (2.) It may

be infiltrated into the substance of the brain; or (3.) It may be detected on the convolutions, in the shape of a ragged ulcer, varying in size from a fourpenny-piece, or less, to that of half-a-crown. It is in this latter form and site of the suppurative process that well-formed pus-corpuscles can most frequently be detected.

In abscess of the brain the surrounding substance is generally of the natural colour, except in a very few cases in which it succeeds to apoplectic effusion, when the walls of the cavities are dyed by the previously extravasated blood. Dr. Baillie says, when the abscess is of large size, the weight of the pus breaks down the neighbouring parts, and they look simply as if they had been destroyed, or very much injured by the pressure; and also when the abscesses are small there is an ulcerated appearance of the cavity in which the pus is contained. In other cases the usual membrane of an abscess forms. This membrane is at first extremely delicate and easily torn; but as the patient continues to live, the membrane lining the abscess becomes of greater consistency, and even of considerable density, so that in some cases it is fibrous, fibro-cartilaginous, and even ossified, thus laying the basis for the formation of bony tumors of the brain.

Inflammatory *ramollissement* of the brain is looked upon as an essentially fatal disease, and the patient seldom survives the formation of an abscess; but it is apprehended that the pus may be occasionally absorbed, and that the opposite walls may unite by granulations, and leave an areolar-tissue cicatrix. Nevertheless, there is some evidence, also, that inflammatory ramollissement is capable of being cured. The *post-mortem* evidence of this fact is the disappearance of one or more layers of the cortical substance, probably by absorption, while the pia mater adheres to this part of the brain. The evidence of the cure of ramollissement in the grey matter of the *corpora striata* and other central parts is the presence of a number of "holes," resembling Parmesan cheese, of a red colour when there has been transudation from the blood-vessels, and of a fawn colour in other cases. The part is atrophied and softened; while the holes may be filled with a limpid fluid, sometimes lined with a membrane (Dr. Simms, *Med. and Chir. Trans.*, vol. xix., p. 413).

Gangrene.—There is also evidence of the brain-tissue becoming gangrenous, as a result of the inflammatory process, equally free

from the red coloration. Mr. Stanley has shown, in his cases of hernia of the brain, that where portions of the brain have *sloughed* away, they have *granulated* again, and have passed into a state of gangrene, often exhaling an exceedingly fetid odour. It is probable, however, that death of the brain-tissue, as a result of idiopathic inflammation in the form of what is ordinarily known as gangrene, does not usually occur. When the softening is truly gangrenous, it is generally after wounds and injuries, and does not differ from gangrene in other parts; the debris is "of a greyish, brownish, or greenish colour, sanious and very fetid" (JOHN HUNTER, JOHN BELL, and others).

White softening or *atrophic softening*, and due to interruption of the circulation, is the result of imperfect nutrition, owing to deficient supply of blood, and is in most instances dependent on mechanical obstruction or degeneration of the cerebral arteries. There is undoubtedly a softening which results from obliteration of the cerebral arteries, consequent on coagulation of the blood in them, or on obstruction from clots of fibrin (CARSWELL, HASSE, KIRKES, SANKEY). But Mr. Paget has shown that such softening is more probably the result of a fatty degeneration of the brain-tissue, as a result of the deprivation of its nutrient material.

Thus softening of the cerebral substance, although characterized by some distinctive phenomena during life, cannot be regarded as an affection *sui generis*, apart from inflammation as now understood (vol. i., p. 64), of which it is simply the result.

The two hemispheres of the brain suffer from ramollissement with nearly equal frequency; and ramollissement of the cerebellum is much more rare than of the brain. But it is not determined whether the grey or the white matter is the more liable to inflammation. Bennett has been led to consider the white as the more frequently softened, while Gluge is of opinion that it is more frequently the grey; but it must be remembered that the grey matter is naturally specifically lighter than the white, and probably also from its structure more amenable to the softening process.

Induration.—Instead of being softened, the texture of the brain is not unfrequently indurated, as a result of the inflammatory process, and is associated, also, with an absence of red colour. It acquires the consistence of the white of egg boiled

hard. M. Dance gives the case of a patient who received a blow on the head about seven months before his death. He afterwards suffered from epistaxis and severe and frequent paroxysms of headache. At length he fell down in walking from the bath, and died convulsed in about a quarter of an hour. On inspecting the brain the convolutions were flattened; there was very little blood, and no serous fluid in the encephalon; but all the substance of the brain resembled white of egg boiled hard. Its weight and density were considerable, and it yielded and recovered its form like an elastic body. There was no trace of a red vessel; but the cortical substance was paler, and the medullary substance whiter than usual (*Répertoire Général d'Anatomie et de Physiologie*, 1828).

Causes.—Inflammation of the substance of the brain may be caused by any of the morbid poisons associated with the *specific* or *constitutional* diseases. Many cases also result from mechanical injuries; others from the excitement of insanity and uncontrolled moral feelings. In some instances encephalitis has followed the suppression of a cutaneous eruption, or the accidental inclusion of a nerve by a ligature applied to a blood-vessel (LALLEMAND, quoted by SIEVEKING). In others, caries of the bones of the cranium, and especially of the petrous portion of the temporal bone caused by *otitis*. Intemperance in alcoholic fluids also is a frequent cause of this, as well as of every other disease of the brain. The disease is sometimes brought about idiopathically, by exposure to the sun's rays in very hot summer days, especially in tropical climates. As a secondary disease, encephalitis is produced by cancer, tubercle, and by every other structural disease incidental to the brain textures.

Encephalitis occurs at every age: in childhood during the tendency to hydrocephalus; in adult age from the action of morbid poisons, and from mechanical and moral accidents; and in old age from the natural decay of the frame. Ramollissement of the brain has occurred at the following ages in a given number of cases:—In a few cases from birth to fifteen; 39 cases occurred from fifteen to forty; 54 cases from forty to sixty-five; and 60 cases from sixty-five to eighty-seven. The frequency of this disease, therefore, increases with age. Men are supposed to suffer in a larger proportion than women, probably from their greater exposure to the exciting causes.

The Symptoms of *encephalitis* have considerable latitude. In twelve severe cases related by M. Paroisse, and resulting from wounds, he states that the symptoms were nearly the same in all, and were as follow:—The men all stated that after the sabre wound they had felt no other inconvenience than local pain of the injured part, and that for two or three days afterwards they had all been able to march five or six leagues a day. On the third day, however, they had all been seized with fever, which terminated on the evening of the fourth day; but from that period they had suffered little, always preserved a good appetite, and prayed not to be put on a low diet. About the seventeenth day they became downcast and dejected, owing, probably, to many sloughs being detached, and much suppuration taking place about this time. On the following day they first lost the sense of smell, and then the senses of sight and taste. With these symptoms, but without fever or convulsions, they fell into an easy sleep; and, as if they had no further strength to contend with the disorder, they died between the nineteenth and twenty-second days from the infliction of the wound.

The symptoms which have been related by Paroisse agree entirely with those observed by John Hunter. He observed that trifling wounds of the membranes of the brain were often followed by severe and extensive inflammation of those tissues, and by very dangerous symptoms; but if the injury had been great, so as to have excised a portion not only of the arachnoid, but also of the substance of the brain, that the symptoms which followed were comparatively slight—a circumstance which he attributed to the brain in the latter case having room for expansion; and he therefore suggested the propriety of extensively incising the arachnoid and pia mater in all cases in which the dura mater alone had been wounded.

In idiopathic inflammation the case may be acute or chronic. The first stage of the acute form is generally of short duration, and in so far the attack may be said to be sudden; and if there have been preliminary symptoms of ill-health, the symptoms have generally been headache or long-continued derangement of the digestive organs. *The general symptoms* of the first stage are but feebly marked (unless *meningitis* predominates). There is usually, in the first instance, some heat of head and of surface

generally. The face is pale, and the pulse low and irregular. The breathing is variable and sighing. There is slight feverish oppression, with headache and vomiting. *The nervous symptoms* are generally highly marked, and so are those of diminished functional activity in cases where the cerebral affection predominates as distinct from the meningeal. They consist of—

1. *Mental Phenomena.*—The patient is sullen, and his faculties become obscured. There is confusion of Thought rather than delirium, which occurs only in a mild form when the patient doses.

2. *Sensorial Phenomena.*—Unless meningitis is present, there is no hyperæsthesia; but there is deep-seated, violent, oppressive pain, frequently described as shooting from the centre to the vertex, the temples, eyes, or ears; and it is out of all proportion to the intensity of the febrile phenomena; and while the febrile phenomena subside (as they very generally do in the course of twelve or twenty-four hours) the local pain does not diminish.

The second stage may be ushered in by convulsions; or, after the first stage has lasted two or three days, the pulse usually becomes rapid and weak. The cerebral nervous functions become inactive, anæsthesia, paralysis, and coma commonly follow two or three convulsive paroxysms, and death follows after the first stage has lasted two or three days.

When the signs of meningitis co-exist and are unusually severe, the pain deep-seated, and followed, after twelve or twenty hours, by convulsions and coma, there is commonly meningo-cerebritis of considerable extent.

When the cerebritis is local or partial, the symptoms are those which are usually regarded as indicating "inflammatory softening," "red softening," as commonly called, or "acute ramollissement." Premonitory symptoms are common, and consist of—

1. *Mental Symptoms*—namely, some loss of intellectual vigour, failure of Memory, confusion of ideas, irritability of temper, and a consciousness of weakness—these symptoms becoming gradually persistent.

2. *Sensorial Symptoms*, such as pain of the head, dull, deep-seated, fixed, and protracted; tingling or numbness in one limb or side; imperfection of the special senses; dimness of sight; dulness of hearing.

3. *Motorial Symptoms*, as evinced in the loss of power of one

limb or side—the most important of all the premonitory symptoms.

There is more or less fever in proportion to meningitis: there is heat of head, vomiting, and general malaise. The signs of meningitis, on the other hand, may be feebly marked; but there may be convulsions, followed by coma, partial paralysis, with rigidity returning more or less rapidly, and ending fatally in a day or two, or from two to three weeks. Thus there may be the symptoms of meningitis, or of cerebritis, of both together, or alternately; and, occurring with such premonitory symptoms as have been indicated, they leave little doubt of the existence of a partial cerebritis.

Although we have seen that the anatomical conditions of the brain-substance generally in acute *ramollissement* are by no means associated with any appearance of much red blood, yet the clinical history of the disease seems closely to resemble that of cerebral hæmorrhage, and it is very often impossible to tell whether the physician has to deal with a case of *apoplexy*, as commonly understood, or a case of *cerebral softening*. The premonitory symptoms peculiar to softening appear to be absent in a half, or more than a half, of these cases (ROSTAN, DURAND FARDEL). In some instances, however, the premonitory symptoms just noticed afford strong probability of softening, and are of much value: the absence of them, however, cannot be regarded as equivalent to the absence of softening (REYNOLDS).

The attack itself may be gradual or sudden. Thus, after the progressive development, during some hours or days of such premonitory symptoms as have been mentioned, the patient gradually becomes apoplectic, or he may at once appear to become so suddenly and instantaneously, without the premonitory symptoms. In the latter case, however, the attack is due to congestion; it gradually passes away, and the patient recovers Intelligence for a time, but the confirmed symptoms of softening remain as follows:—

1. *Mental Symptoms.*—Transient excitement or mild delirium may precede the abolition of Perception; and when this does occur it is highly characteristic. Coma is frequently developed abruptly, and is often of the following peculiar character:—The patient lies still, as if in a profound sleep, but immediately gives the hand or puts out the tongue, if told to do so, Intelligence

remaining intact. The loss of Perception and Volition, however, is not recovered from. Dulness and obscuration of Thought and Perception prevail often to a marked degree.

2. *The Sensorial Symptoms* are not so well marked as the motorial. Hyperæsthesia has erroneously been considered pathognomonic of ramollissement, perhaps because it is more common in softening than in any other apoplectic disease. Numbness and a sensation of cold are not at all unfrequent.

3. *The Motorial Symptoms* are of two kinds—namely, paralysis, and spasmodic contractions of muscles. The face-muscles act unequally, producing deviation of the features, sometimes very slight, at other times highly marked. Speech is almost constantly impaired, and after slight recovery it continues to be so. Paralysis is commonly limited to one side, sometimes to one limb, but in rare cases it is general. The spasmodic contractions are either of a tonic or of a clonic kind, rigidity or occasional spasm being found in either the paralyzed or non-paralyzed limbs,—most commonly in the former.

The physician, however, will not derive much information from the mere recognition of the presence of single symptoms: it is by a close observance of their combinations that exact diagnosis will be insured. The following combination of symptoms are those which may with most probability be referred to softening:—

(1.) Imperfect coma, partial loss of Perception and Volition, with rigidity of the limbs; (2.) Perfect coma without rigidity; (3.) Paralysis without loss of Consciousness; (4.) Paralysis with hyperæsthesia; (5.) Rigidity, coming on after the return of Perception and Volition.

The after-symptoms of softening are also strikingly different from those of apoplexy. The morbid phenomena do not suddenly disappear, nor is there the gradual improvement which takes place after apoplexy. Enfeeblement of the mental powers most commonly persists, and the motorial phenomena remain. Slight apoplectic-like seizures occur, convulsive movements and rigidity increase, and some little febrile excitement becomes developed, which in severe cases generally assumes a typhoid type, with brown tongue and rapid pulse. From such a condition recovery is rare.

The duration of life in *ramollissement* of the brain is various; but in 109 cases the disease terminated within the periods indicated in the following table:—

DURATION OF LIFE IN CASES OF SOFTENING OF THE BRAIN.

1	died	in	12	hours.	2	died	in	12	days.	1	died	in	35	days.
1	,,		15	,,	3	,,		13	,,	1	,,		36	,,
1	,,		24	,,	3	,,		15	,,	1	,,		47	,,
1	,,		32	,,	1	,,		16	,,	1	,,		49	,,
5	,,		2	days.	2	,,		17	,,	1	,,		60	,,
9	,,		3	,,	4	,,		18	,,	1	,,		65	,,
5	,,		4	,,	5	,,		20	,,	1	,,		68	,,
4	,,		5	,,	3	,,		21	,,	1	,,		190	,,
7	,,		6	,,	1	,,		22	,,	1	,,		220	,,
8	,,		7	,,	1	,,		23	,,	1	,,		5	months.
8	,,		8	,,	1	,,		25	,,	2	,,		6	,,
3	,,		9	,,	1	,,		29	,,	1	,,		1	year.
5	,,		10	,,	4	,,		30	,,	2	,,		3	years.
4	,,		11	,,										

It thus appears that *ramollissement* of the brain is more frequently an acute than a chronic disease, the greater number dying before the twelfth day, while at the end of a month only sixteen cases out of the 109 were living.

In the thirteen cases which have been collected of ramollissement of the *cerebellum*, the impairment of Intellect was trifling, while motion was greatly affected in all except one doubtful case. In ten cases there was palsy with or without contraction of the muscles of the opposite side of the body; in two others, convulsive actions of both sides of the body; and in the last case observed by Rostan the palsy was on the same side. In this case the disease depended on an exostosis of the petrous portion of the temporal bone. In no instance is it said that any sexual desire troubled the patient.

The symptoms of abscess of the brain are likewise extremely obscure. In a case treated for disease of the nose, the man made no complaint of his head, and was able to sit up in bed, and to assist himself in every way. He died suddenly in the night. An abscess of considerable size was found in the left hemisphere above the ventricle. In other cases, pain, delirium, coma, palsy, and sometimes convulsions, were the symptoms observed. The convulsions were observed most frequently to occur when the abscess formed in the *tuberculum annulare*, or in the *medulla oblongata*, or so close to these structures that the growth of pus would affect their functions simply by its pressure (Baillie, *Morbid Anatomy*, p. 457).

Of eighty instances of abscess of the brain, collected by Professor Lebert, twenty-two of them, or above a quarter, were cases of scattered abscesses in various parts of the brain; the remaining

fifty-eight were cases in which solitary abscesses were found in some part of the encephalon, distributed as follows:—

Left hemisphere,.....in 23 cases.	Cerebellum,.....in 12 cases.
Right ,, ...in 18 ,,	Pituitory body, ...in 2 ,,
Corpora striata, ...in 2 ,,	*Medulla oblongata*,.....in 1 case.

In the case of multiple abscesses there were never more than five, sometimes three or two only.

The abscesses generally occupy the white substance, and only affect the grey matter by extension. In form the abscesses are generally oval, and vary in size from a pea to the size of a hen's egg or larger; so that one entire hemisphere has been found converted into a pouch filled with pus. The pus is generally of a greenish colour, of considerable density, and rarely containing blood. Sometimes it is very fetid. It is generally granular, not containing many well-formed corpuscles; and the older the abscess the more the pus-corpuscles are found to be degenerating. Pus is generally found infiltrating the cerebral tissue surrounding the abscess; and in the zone beyond, the tissue is softened, while if the process be recent, a zone of vascular redness surrounds the whole. Connective tissue ultimately grows in a condensed form round the site of abscess, and closes the whole with walls of considerable thickness, (1 to 4 *millim.*) Often these walls are very vascular. There does not seem to be any evidence that these encysted abscesses are ever cured.

The lateral ventricles are the parts into which the abscesses most frequently burst. Thickening of the *ependyma* follows, and scattered spots of inflammatory softening may be found in the neighbouring tissue. In some cases the abscess makes its way outwards through the petrous portion of the temporal bone or the aural passages.

The most frequent cause of cerebral abscesses is internal *otitis*—a lesion which often results from *scarlet fever, typhus fever, small-pox, measles,* or *scrofula.* They also occur as the sequelæ of inflammations of distant parts, as of *pneumonia, pericarditis, enteritis.* They may also occur as so-called metastatic abscesses, and as a result of traumatic injury.

The latent character of brain-abscess is important in diagnosis. Sudden headache is the symptom which most frequently excites attention; and it is generally accompanied by febrile

symptoms and vomiting. The patients become heavy, morose, and may be delirious, with contraction of the pupils and photophobia. Difficult articulation, numbness, formication, and convulsive attacks may supervene. While the Intellect may suffer comparatively little, sensibility suffers more frequently; and headache, generally at first diffused, is more or less intense, and subsequently becomes unilateral. Coma occurs frequently, is often temporary, and paralysis occurs in about one-half the cases. The paralysis is generally local; but it may assume the form of general muscular debility. The duration of such cases fluctuates from two or three weeks to two months (LEBERT, SIEVEKING, in *Med.-Chir. Review*, 1857, p. 526).

Schott has analyzed forty cases of abscess of the brain. He finds *otitis, pyœmia,* and injuries to be the most frequent causes. In cases of *otitis* the abscess formed mostly in an imperceptible manner; and in cases of injury the symptoms were very transitory. Encephalitis was present in acute cases (*New Syden. Soc. Year-Book*, 1862, p. 79).

Syphilis is by no means an infrequent cause of circumscribed encephalitis, which terminates in the formation of gummatous tumors in the brain; or it induces internal periostitis, with inflammation of the membranes, with or without *hœmatoma* of the *dura mater*. There are generally in such cases syphilitic lesions in the liver and in the inguinal glands. (See under "Syphilis," vol. i., page 770, *et seq.*)

The symptoms of hydatids of the brain are often very obscure. The slowness with which they form probably often causes the brain to become accustomed to their presence, and consequently they do not give rise to any very prominent symptom. Cruveilhier gives a plate of a hydatid occupying the internal surface of the right hemisphere, immediately above the *corpus callosum*, and which caused no cerebral symptoms. Dr. Baillie gives a case in which a serous cyst as large as a gooseberry pressed on the optic nerves at their junction, and yet the pupils were not dilated nor the eyesight impaired till within a day or two of the patient's death. In other cases they cause severe headache, palsy, loss of sight, or of other senses, and also absorption of the bones of the cranium, followed by coma and death.

Diagnosis.—The great difficulty in the diagnosis of acute ramollissement is to distinguish it from apoplexy. In most cases it is

not possible to make the distinction. "On the other hand," writes Dr. Maclachlan, "there are numerous cases of acute softening which can scarcely be mistaken for cerebral hæmorrhage. In such a combination of symptoms as the following—and I do not group them artificially, but as I have repeatedly observed them—the probabilities are, that the case is one of acute softening, and not sanguineous apoplexy:—After several days' suffering from headache, giddiness, drowsiness, dulness of comprehension, tingling or numbness in the toes or fingers, followed by sudden hemiplegia, without loss of consciousness, the probabilities are, that the symptoms are due to softening instead of hæmorrhage. If to these symptoms succeed pains in the palsied limbs, and diminution or exaltation of the cutaneous sensation, while the symptoms maintain a variable rather than a fixed character, whether the palsied limbs are contracted or relaxed, or alternately contracted, the chances are still greater that the case is one of softening; and the diagnosis may be considered as established should the paralytic symptoms, and with them the associated stupor, preserve this vacillating, impulsive peculiarity, there being periods of amelioration followed by increasing coma and increasing palsy" (l. c., p. 193).

Prognosis.—The prognosis in every case of encephalitis is grave; but, as far as we can judge, even acute cases recover, and live for many years afterwards, notwithstanding the unfavourable opinion expressed by Rostan. The changes seen in the brain after death in cases which have recovered have already been noticed (p. 288, *ante*).

Treatment.—In diffuse inflammation of the brain arising from mechanical injuries there can be no doubt that bleeding and antiphlogistic treatment generally are most beneficial, when employed with a wise discretion and at an early period. When, however, inflammation occurs during the progress of a *zymotic* or *constitutional* disease, it is necessary that such measures be employed with the greatest caution, and in the majority of such instances they are better omitted altogether; for we find in many cases of typhus fever, in which the brain is probably partially impaired in consistence, that the patient recovers under a stimulant treatment.

In acute idiopathic *ramollissement* of the brain the treatment can hardly be said to be yet determined; but there is good reason

to believe that general bleeding is only to be practised with benefit when the disease is associated with congestion of the brain. Most advantage is to be derived from the use of tonics, and of a nutritive diet. As a general rule, *cerebritis* does not admit of so copious depletory measures as *meningitis*. In acute cases, where the premonitory symptoms of congestion are obvious and urgent, bleeding may be carried to a considerable extent, consistent with the nature of the case and the individual; and after a reasonable quantity of blood has been taken without producing nausea or fainting, the bleeding may be again repeated till some decided impression is made. In many cases, on the other hand, cupping, or bleeding by means of leeches to the temples or back of the ears, may be more useful than venesection. Such cases are indicated by the signs of determination of blood to the head, heat of the scalp, suffusion of the eyes, redness of the face, with or without inordinate action of the carotids. Such cases are also more likely to be benefited by the cautious repetition of this treatment than by general bloodletting, which can very seldom be required in softening of the brain occurring in persons turned of fifty (MACLACHLAN).

Even when the pulse may seem to warrant bleeding, and at a time when bleeding may seem safe and proper, it is advisable, before having recourse to this measure, carefully to examine the state of the heart, the state of the arteries at the wrist, and the condition of the corneæ. By such an examination, assisted by the previous history of the case, the condition of the cerebral arteries will best be indicated, and the readiest clue gained to the probable nature of the cerebral affection. If the heart's action and sounds are feeble, or if signs of valvular insufficiency are present, it is probable that the softening is anæmic, atrophic—a consequence of partial inanition, and not of partial cerebritis. This conclusion is still more probable if the radial arteries are rigid, and if the *arcus senilis* is fully developed. To bleed under such circumstances is unwarrantable.

In severe seizures resembling apoplexy the bowels should be opened by an enema of castor oil and turpentine. In less urgent cases, where there has not been loss of consciousness, or where it has been restored and the patient is able to swallow, a purgative of colocynth and calomel, with or without croton oil, may be substituted for the enema. Perfect rest in the recumbent posture

must be enjoined, with the head slightly elevated, and all constrictures of dress removed from the neck. The scalp should be kept cool by rags dipped in cold vinegar and water, or iced water. If much re-action supervene, leeches may be applied to the head; and should the pulse be weak, twenty or thirty drops of the *spiritus ammoniæ aromaticus* may be administered. The catheter may require to be used; and the bladder must always be examined, in case the urine may be retained. Nourishment must be given in small and oft-repeated quantities.

If sanguineous effusion has actually happened, *calomel*, to the extent of permitting the mouth to be made slightly tender, is believed by not a few to encourage the absorption of the fluid. It can only, however, be given in healthy subjects, free from gouty or renal disease; and Dr. Maclachlan recommends that it may be given in the form of *three* or *four* grains of blue pill and two of James's powder every evening for ten days or a fortnight, the effects being carefully watched, so that the gums should not be more than touched.

To allay the pains in the palsied limbs *opiates* are of great value. They procure sleep and moderate tetanic rigidity of the flexor muscles. *Muriate of morphia* may be given in doses of one-sixth to one-fourth of a grain at bedtime; and the doses may after a time be increased, if necessary; and may be combined with extract of colocynth or croton oil, to counteract the tendency to constipation (MACLACHLAN, l. c., pp. 195, 196).

In chronic cases local bleedings from the temples, or from behind the ears, combined with moderate purgatives every three or four days, are demanded in most cases, with a blister applied now and again to the nape of the neck; and as much as possible the currents of blood must be diverted from the brain. Headache and stupor are generally relieved by full feculent evacuations. The diet ought to be strictly that of a vegetarian, and as little stimulant as possible (WOOD).

In the more chronic, and although ultimately fatal, forms of the disease, life is evidently prolonged by mild tonics, attention to the bowels, and by a liberal and nutritious diet, with such a graduated allowance of alcoholic beverages as the case may require. Beyond this the medical treatment of ramollissement of the brain is still a problem, with only a few unsure data to guide us for its solution.

ATROPHY AND HYPERTROPHY OF THE BRAIN.

Atrophy of the brain or diminution of its substance, without induration or softening, is usually congenital, or the consequence of some severe hydrocephalic disease, or of old age, or of long-standing exhausting diseases, especially in children, serum being effused in the space between the brain and its coverings, in order to supply the deficiency of bulk. Sometimes also one side may be more atrophied than another; the membranes appearing to be greatly shrivelled after the fluids escape; the convolutions are thin, and the sulci wide. The sufferers are generally idiotic, and possess but little use of their limbs. Andral gives a singular case, in which the patient, a girl, though an idiot, was able to do little errands in the neighbouring villages, and lived to an early adult age, yet, when examined after death, she was found to have no trace of cerebellum.

Hypertrophy of the brain is usually connected with hydrocephalus, or is probably caused by some inflammatory action. Those persons who thus suffer seldom possess much power of Intellect, but their faculties generally are less impaired than in cases of atrophy.

SECTION II.—CEPHALIC DISEASES, CHARACTERIZED BY A GROUP OF SYMPTOMS COMMONLY CALLED APOPLECTIC.

The literal meaning of the term *apoplexy* conveys the idea of a *sudden stroke*, and it has been usual to confine the term to the results produced by extravasations of blood into the nervous tissue of the brain, a portion of which is thus destroyed. More comprehensive pathological doctrines teach us to give a wider signification to the term. It is now used to characterize a group of symptoms irrespectively of the anatomical conditions upon which they may depend. These symptoms consist of—(1.) Premonitory warnings, extending over variable periods (seconds, weeks, months, or years), marked by sundry derangements of the nervous functions, such as loss of Memory, dulness of Sensation, or diminished power; (2.) The individual is more or less suddenly deprived of Volition and Perception in their relation to Sensation and Motion. Consciousness is thus more or less lost, and paralysis is more or less complete. The patient may fall to the ground completely insensible, or he may only stagger and

cling to some object for support. The respiration and circulation may be unaffected, or the former may be stertorous and the latter laboured. Some group of muscles, a side of the body, or the whole body, is paralyzed, flaccid, motionless; or it may be rigid with tonic, or convulsed with clonic spasm. From this state the patient may never recover. Life becomes gradually extinguished, or the sufferer may recover partially or entirely; in the former case leaving some mental, motorial, or sensorial faculty impaired for weeks, or for the whole of after-life. The essential phenomena of an apoplectic seizure consist in the severance of the brain-functions, namely, Volition and Perception, from Motion and Sensation: the other symptoms that occur are additional phenomena, depending on secondary changes subsequently induced in the part, or its vicinity, which has been the primary seat of lesion.

The essential phenomena of the *apoplectic state* are found to be due to a variety of local lesions, or complex morbid states, and not to any constant lesion. One or more of the following local lesions or complex morbid states may induce the apoplectic condition, namely,—(1.) *Congestion of the brain,* or what is commonly called *determination of blood to the head—congestive apoplexy.* (2.) *Hæmorrhage,* or *extravasation* (a.) *into the substance of the hemispheres* or *cerebellum,* (b.) *into the ventricles,* or (c.) *into the arachnoid cavity. One or other of these lesions* (*under* 2.) *constitutes apoplexy* in the common acceptation of the term—*sanguineous apoplexy* or *cerebral hæmorrhage.* (3.) *Sudden serous effusion in large quantity* is equally efficient in bringing about the apoplectic state commonly called *serous apoplexy.* (4.) *Local cerebritis,* or *softening of the brain,* produces, as already shown, symptoms, in the first instance, of an apoplectic kind. So also do (5.) *Tumors of the brain,* or *meningitis;* (6.) *Tuberculous meningitis;* (7.) *The progress of various specific and constitutional diseases from blood-poisoning;* (8.) *Anæmia,* as in the *hydrocephaloid disease of children, disease of the heart, and vascular obstructions.*

To the phenomena produced by the first three of these conditions only has it been common or usual to apply the term—

APOPLEXY.

LATIN, *Apoplexia;* FRENCH, *Apoplexie;* GERMAN, *Apoplexie*—Syn., *Hirnschlag;* ITALIAN, *Apoplessia.*

Definition.—*A disease essentially characterized by the sudden loss, more or less complete, of Volition, Perception, Sensation, and Motion, depending on sudden pressure upon the brain (the tissue of which may be morbid), originating within the cranium.*

Pathology.—This disease was well known in the Greek and Roman schools of medicine, and is of too frequent occurrence, and of too striking a character, to have escaped observation even in the rudest ages of society. Patients have died with undoubted apoplectic symptoms when nothing has been found but congestion of the vessels of the scalp, of the membranes of the brain, and of the brain itself, but without the extravasation of a particle of blood. More generally, however, a greater or less quantity of blood has been effused either into the cavity of the arachnoid, into the substance of the brain, or into some of the ventricular cavities. Thus it is that the lesions found in cases which die of undoubted apoplectic symptoms vary much. Sometimes the evidently congested state of the brain during life leaves no trace visible after death. Such cases have been described as "nervous apoplexy" (SANDRAS). Although much stress is laid upon the fact that "a sudden pressure upon the brain is necessary to produce the apoplectic state," yet it is difficult in all cases to account for the proximate cause of the disease by such an explanation; for when the quantity of blood extravasated has been not larger, for instance, than a barley-corn, it is difficult to account for all the phenomena by mere pressure. The ideas or theories which have thus been formed to account for the apoplectic state may be shortly stated as follows:—(1.) The result of sudden pressure, effected by causes within the cranium; (2.) From a peculiar morbid state of the nervous matter of the brain, and which predisposes to the extravasation of blood (DRS. ROBERT WILLIAMS, WOOD, SIEVEKING)—an apoplectic orgasm, as it has been called by some, but which is probably of the nature of softening (ROCHOUX); (3.) A morbid condition of nerve-matter and minute blood-vessels, also probably of the blood itself (BOUILLAUD, PAGET), and in connection with chronic renal disease (BRIGHT, BURROWS, CHRISTISON, KIRKES).

When the quantity of blood extravasated is small, the disease is seldom fatal from the first attack; but the rapidity of the fatal issue appears to bear some relation to the vicinity of the hæmorrhage to the *medulla oblongata;* and the effusion of blood into the ventricles is also generally most rapidly fatal.

In examining apoplectic cases it is therefore not unusual to find a cavity scarcely bigger than a barley-corn in the substance of the brain, the evidence of the primary attack, and containing a clot of blood variously changed. If the blood be effused among the membranes, it may be altogether absorbed, and not a trace of disease be found. In severe cases still greater quantities of blood are effused; and if the apoplexy destroy the patient in a few minutes or a few hours, the quantity of blood effused will sometimes fill the whole cavity of the arachnoid, or extensively rupture the substance of the brain, forming a cavity as large as a nut or an egg, or even lay the ventricles into one cavity.

It is rare that sanguineous effusion occupies both cerebral lobes, or the whole extent of the membranes of the brain, although such instances are occasionally seen. More commonly it is limited to the substance of one hemisphere, or to the membranes covering it, or to the cavity of a ventricle. When the membranes of the brain are affected, the more immediate seat of the hæmorrhage is usually that portion covering the convexity of the brain. This varies, however, so that the portion covering the base, or that investing the cerebellum, or, indeed, any other part, may be its seat.

The superficial membranes of the brain are not the only membranes of that organ which are the seat of apoplectic effusion. Hæmorrhage may take place from the membrane lining the ventricles, and which sometimes bleeds so profusely as not only to fill the lateral ventricles, but even to enlarge their cavities. As death in these severe cases is usually sudden, the walls of the ventricles are generally healthy; but in some very few instances the *septum lucidum* has been found ruptured, and the ventricles have freely communicated. The smaller ventricles are in a very few instances also the seat of apoplectic effusion. Dr. Abercrombie gives a case in which the third and fourth ventricles were filled with blood. The patient was not at first insensible, but gradually became so, and died in a few hours.

The appearance of the blood effused into the membranes of

the brain varies according to the time which elapses before the patient dies, thus affording opportunity for its examination. If that event takes place in a few hours after the attack, the blood is still fluid, or is found in black clots, while the membranes, except being infiltrated with blood, are as yet healthy. The substance of the brain, likewise, has no other appearance of disease than that of being flattened, from the presence of the extravasated blood. If the patient, however, survives a few days, the membranes show marks of inflammatory action. They are injected, thickened, and although dry and pitchy-like in the immediate neighbourhood of the clot, have yet some serum effused in other parts of the space they enclose. The convolutions of the affected part of the brain are likewise now not only flattened but softened. Thus various processes immediately commence in the blood after it is extravasated, as well as an interchange of processes between the blood and the surrounding parts. The most obvious of these phenomena are the formation of a coagulum or clot; its solution, and the formation of blood-crystals; the gradual absorption of the more fluid constituents; the formation of an organized membrane round the clot; continuous absorption of the exudation; induration of the surrounding cerebral parts; contraction of the cavity, and ultimately the formation of a cicatrix. Those changes are effected with various degrees of rapidity, depending on the site and extent of the extravasations, the healthy state of the nervous texture, and of the patient constitutionally.

When effusion has taken place into the substance of the brain, if the patient has died in the fit, or shortly after, the hæmorrhagic cavity is found filled with half-coagulated blood, its walls irregularly softened, and dyed to the extent of some lines deep with the colouring matter of the blood; and a small stream of water directed upon this part at once removes the extravasated blood, and also a layer of softened cerebral matter. Again, if the patient has survived a week, the blood is found coagulated, and the serum set free; but the presence of the clot has caused inflammation, so that the walls of the cavity are not only discoloured, but more decidedly softened, and are softer in proportion as they are nearer the clot. If life be prolonged till the fifteenth day, the serosity is absorbed, but the walls of the cavity are still of a deep red. About the seventeenth day Virchow has discovered

blood-crystals, or hæmatoid crystals, in the cavity. These blood-crystals were first discovered by Sir Everard Home, and have been more recently described, and their nature explained, by Funke, Kunde, Lehmann, Beale, Parkes, and Sieveking. It appears that these crystals do not form from clotted blood until the blood-corpuscles have become ruptured by endosmosis. Their contents then escape and crystallize as the solution gradually becomes concentrated (BEALE). Thus another guide to the age of the clot exists in the presence of these crystals. About the thirtieth day, if the patient lives so long, the clot is isolated, and a membrane forms, at first muciform, fragile, intermixed with particles of cerebral matter, and also with some of the colouring matter of the clot. By degrees this membrane becomes more consistent, the clot diminishes, and some serum is probably secreted by the new membrane surrounding it. The cyst has also been found fully formed, organized, and nearly empty, by the thirteenth day (MACINTYRE); and by the seventeenth day after extravasation it has been found to contain sanguineous fluid (MOULIN, SIEVEKING). The cerebral walls surrounding the cyst, previously softened, now become indurated, and are stained yellow from the usual changes which the extravasated blood with which they are penetrated undergoes—a colour, however, which they ultimately lose. The cavity thus formed may be filled at length with serum only; or, the serum being absorbed, the membranous cyst may ossify, and may be thus converted into a bony tumor. At other times the opposite sides of the cavity unite by a kind of areolar membrane, which thus forms a species of cicatrix, but possessing so little power of conducting nervous influence that the patient seldom recovers from his palsy. Such is a short outline of the effects of hæmorrhage into the substance of the brain. The size of an apoplectic cavity varies from a barley-corn to that of an egg, and their number is as variable as their extent. Sometimes we find but one, sometimes two, and in a very few instances three or more cavities. When many apoplectic cavities exist in the brain, it is rare to find them all in the same state. Some are old and almost obliterated, others are fresher, and others again quite recent, their different stages marking a distinct and different period of attack. An account of a most interesting case of this nature is given by Dr. Fuller, in which there were *six* clots, each of a different date, and in

different stages of discoloration, and corresponding to each of six well-marked apoplectic seizures in the course of nine months (*Diseases of the Chest*, p. 602).

Some of the most exact data we possess regarding the pathology of apoplectic seizures are to be found in the *Transactions of the Pathological Society of London*. Up till 1857, lesions of the brain connected with apoplectic seizures have been shown at the Society in *fourteen* cases. The position of the blood effused in these cases was as follows:—(1.) Superficial meningeal effusions, five cases; (2.) Within the substance of the hemispheres or the *central ganglia*, four cases; (3.) In the *pons Varolii*, two cases; (4.) In the *pons Varolii* and *crura*, one case; (5.) In the *pons Varolii* and *cerebellum*, one case; (6.) In the *pons*, *crura*, and *cerebellum*, one case.

Superficial or *ventricular* extravasation occurred in five cases; that is, the blood lay in a more or less coagulated mass under the arachnoid over the hemispheres, and was most abundant at the base and about the roots of the nerves. In two of the cases there was some evidence of previous *meningeal* disturbance. This evidence consisted of adhesion of the cerebral arachnoid and pia mater to the cerebral convolutions along the anterior margin of the middle line of the hemisphere: the history of the other case recorded the occurrence of two previous apoplectic seizures. In it *post-mortem* evidence of previous irritation also existed, in the adhesion of the *dura mater* to the calvarium.

The conditions as to general health of those in whom these attacks occurred were as follow:—One was convalescent from a uterine disease, the nature of which is not stated; another had chronic bronchitis and asthma; in a third intemperance was predominant; and in the fourth there had been two previous attacks of apoplexy. In three of these cases the condition of the heart is recorded as being larger than natural—in one of them weighing $11\frac{3}{4}$ ounces, in another 15 ounces, where the hypertrophy was general. In the case of the repeated attacks the heart was fatty, as well as the coronary arteries and those of the pia mater. The kidneys also were fatty. In all of them the attack was sudden—followed in one by instantaneous death, in the others by insensibility, collapse, and blanched surface. In one case the pupils were dilated; in another, where the *septum lucidum*, *corpora striata*, and *optic thalami* were broken down, there were paralysis and rigid contraction of the right arm. Death followed

in thirty-four hours; another died in twenty-two hours; one on the third day, and another on the fourth. In none of these cases is there noticed any lesion of the brain-substance itself. In all, the hæmorrhage appeared to proceed from the tomentose or vascular surface of the pia mater. In this variety of meningeal hæmorrhage the vessels of the pia mater become inordinately injected, and the effusion consisted of blood, or merely blood-serum (Dr. Williams). While this effusion of blood or serum lies on the convoluted surface generally, it occasionally, as in this instance, is effused into the ventricles, so that the brain was compressed both from the peripheral or pericranial surface and from the ventricular or internal surface. There was no connection of these cases with external injury, the most common cause of extravasation between the pia mater and brain. They all appear to have been the result of morbid states of the vessels of the pia mater. Cases of this kind are recorded by Craigie in the *Edinburgh Medical and Surgical Journal*, vol. xviii., p. 487; also by Morgagni, *Epist.* iii., 2 and 4, quoted by him from Valsalva, *Epist.* xi., 19 (See Craigie's *Pathological Anatomy*, p. 730).

Extravasation into the Substance of the Hemispheres or Central Ganglia.—In four cases some part of the cerebral substance contained the extravasated blood, more or less free, or surrounded by a cyst. In two of the cases the clot was surrounded by a cyst, in one of which, death taking place thirteen days after the seizure, the cyst was found nearly empty, disintegration and absorption having thus early taken place (Macintyre). These cysts seem to be formed of fibrilloid tissue like condensed fibrin, more or less hyaline, or stained with colouring matter of the blood; and in one case, where death occurred twelve weeks after the fit, blood-crystals were found in abundance in those parts of the wall of the cyst, and most abundantly on the yellow parts. In this case, at the end of twelve weeks, the cyst was filled with slightly turbid yellow fluid, a small portion of coagulum only remaining (Bristowe). In the case where the extravasation occurred into the *corpus striatum* it protruded into the lateral ventricle of the right side, and nearly filled it, and the nervous substance around was broken down and soft. Death occurred in half an hour (Gibb). The position of the clot in the fourth case was above the lateral ventricles, separated from the longitudinal fissure only by the grey matter. Some ecchymosis existed in the neighbourhood, and there was yellow discoloration on the surface of the left

corpus striatum, where two cysts existed with fibrous walls, the remains of old extravasations (OGLE).

The conditions as to general health of the patients are not stated. One case occurred during convalescence from an attack of *delirium tremens*, after having been apparently benefited by a dose of morphia amounting to *one* grain of the *acetate*. There was extensive cardiac, pulmonary, and gastric disease in this case, and the patient lived thirteen days after the seizure. A bloated, florid look were the only circumstances to indicate the general state of the case where the extravasation occurred in the hemisphere above the lateral ventricle. In three of the cases the heart is specially noted as fatty, its weight in one instance being thirteen ounces, in which case, also, the liver was enormously enlarged, containing sugar. In all the cases the arteries at the base of the brain were diseased. The symptoms were generally those of a fit, in one case like syncope, when the extravasation was into the ventricles and *corpora striata*, death following in half an hour, preceded by a feeble pulse, the pupils being slightly dilated. In the other case, in which there was *post-mortem* evidence of previous extravasation by the remains of cysts on the surface of the left *corpus striatum*, together with a thickened and opaque arachnoid with subarachnoid fluid, a fit occurred with paralysis of right side, a feeble and quick pulse, followed by convulsions, contracted pupils, and incoherent speech, breathing becoming stertorous, death following by coma on the sixteenth day.

Extravasation into the Pons Varolii and other parts.—Five cases are noted in which the extravasation took place into the *pons Varolii*. In two of the instances the *pons* alone was implicated. In one, the *pons* together with the *crura cerebri;* in another, the *pons* together with the *cerebellum;* and in a third, the *pons* together with the *crura* and *cerebellum* were implicated. Of the cases where the *pons* alone was implicated, a clot the size of a pea occupied its centre. It occurred in a lunatic, taking his walk out of doors in his usual health. Sudden paralysis indicated the seizure, and death followed in twenty-four hours. In the other case (age thirty-four) the *pons* contained a clot as large as a filbert shell, seated in the middle line, the blood having burst through into the fourth ventricle. Surrounding the clot the nerve-tissue was softened and shreddy. The seizure was sudden, with right hemiplegia and anæsthesia. Paralysis of the left side remained,

with feeble circulation, and death followed in five days. In the instance in which the *crura* as well as the *pons* was affected, the blood was partially coagulated, breaking up the nervous matter, and distending the parts into a bag. In the instance in which the *crura* and *cerebellum* as well as the *pons* were implicated, the clot was similarly enclosed in a bag of nervous matter. In the other instance the lesions in the *pons* and *cerebellum* were confined to the left side.

These cases were distinguished by rapid and extensively increasing difficulty of breathing—in two amounting to *stertor*—and by contraction of the pupil; features placid; convulsions of pectoral muscles; coma becoming more and more perfect; and death followed in from four to twelve hours. In three of the cases extensive disease of the vessels, both large and small, especially towards the brain, is noted.

These cases have been related, from the supposed rarity of the lesion as to its seat. And although the greater number of the cases are deplorably meagre in the details recorded in the Society's *Transactions*, yet they are exceedingly interesting on the whole, when thus classified, establishing as they do several facts, not accurately determined before, relating to the pathology of cerebral apoplexy or cerebral hæmorrhage. They confirm the observation that, when the extravasation is extensive, although superficial, the result is rapidly fatal by the coma, resulting from compression over a large surface; that when effusion is sudden and extensive in *certain parts* of the brain, such as in the *corpora striata*, or *optic thalami*, or the *pons Varolii*, the result is rapid death; and generally they confirm the belief that the more nearly the extravasations approach the *medulla oblongata*, the more rapidly fatal is the result. The symptoms which were associated with irritation of the parts connected with the *pons Varolii* were peculiarly well marked in three instances. So delicate are the sensibilities of these parts in the exercise of their functions, that it has been taught that blood is rarely found effused in them as a lesion after death, because simple vascular injection of such parts was considered sufficient to disturb the functions of the brain so much as to produce the fatal result before such changes can be effected, (Craigie's *Prac. of Physic*, p. 309, vol. ii.)

The cases are much too few to found any general conclusion

upon relative to the numerical frequency of lesion in any particular part of the brain, associated with the apoplectic seizure.

It is well established (notwithstanding statements to the contrary, founded on experiments of a certain kind) that the brain-substance is liable to compression from vascular injection generally, and increased turgidity of its vessels. There are also parts of the brain so constituted anatomically that hæmorrhage more readily occurs in them than in other parts. The anatomical constitution which favours this consists in the increased provision for the transit of blood-vessels. For instance, through the white perforated spot at the commencement of the fissure of Sylvius, the sylvian or middle artery of the cerebrum sends its numerous branches of various size into the substance of the brain. These in the first instance penetrate the *corpus striatum*, which lies immediately over this *anterior perforated spot*. The *corpus striatum*, and the parts at its level, from their anatomical position and relations, are thus the most vascular parts of the whole brain; and most pathologists agree in considering these to be the parts most liable in the substance of that organ to effusion of blood, more especially when the vascular system of the brain is overloaded (BONETUS, MORGAGNI, ROCHOUX, ANDRAL, CRAIGIE. Opposed to this belief were—HOWSHIP, LERMINIER, SERRES, TACHERON). A summary of the facts recorded may be stated as follows:—

Site of Effusion.	Andral.	* Tacheron.	† Serres.	‡ Lerminier.	Path. Soc. of London.	Total.
Corpora striata,	61	3	...	1	1	66
Thalami optici,	35	2	...	2	...	39
Portions of hemisphere above centrum ovale,	27	9	2	3	3	44
Lateral lobes of cerebellum,	16	...	...	...	...	16
Before corpora striata,	10	...	...	...	...	10
Mesocephalon,	9	1	2	...	...	12
Spinal cord,	8	...	...	...	...	8
Posterior lobes,	7	2	2	...	...	11
Middle lobe of cerebellum,	5	...	...	...	...	5
Peduncle of brain,	3	...	...	...	...	3
Peduncle of cerebellum,	1	...	...	...	...	1
Corpora olivaria,	1	...	...	...	...	1
Pituitary gland,	1	...	...	...	...	1
Pons Varolii,	...	2	3	...	5	10
Meningeal hæmorrhage,	...	...	...	...	5	5
Level of corpora striata and into them,	202	...	...	...	...	202
TOTAL,	386	19	9	6	14	444

* *Recherches Anatom. Pathog.*, par C. F. Tacheron, tome XIII., Paris, 1823, Ordre XIV., An. 31.

† *Annuaire Med.-Chir.*, p. 324, sect. XI. ‡ Ibid., p. 213.

The result of these observations shows that the comparative liability of parts of the brain to extravasations of blood may be stated in the following order:—

(1.) *Corpus striatum, opticus thalamus,* and hemisphere at the level of these parts; (2.) The *corpus striatum* alone; (3.) The hemisphere above the *centrum ovale;* (4.) The *thalamus opticus* alone; (5.) The lateral lobes of *cerebellum;* (6.) The *mesocephalon;* (7.) Posterior lobe of *cerebrum;* {(8.) Before the *corp. striat.;* (9.) *Pons varolii*}; (10.) {Middle lobe of *cerebellum;* Meningeal hæmorrhage}; (11.) Peduncles and olivary body.

Much more extensive records, however, are required to determine these points accurately; and Rokitansky does not consider as yet that we can state such a result in other than general terms. While the ages of those whose cases are recorded varied from thirty-three to sixty-nine, the average age was fifty-four.

Circumstances under which the Lesion occurred.—In two of the cases the arteries are stated to have been healthy. In three of the cases no mention is made in regard to them; but in three there was hypertrophy of the heart, amounting in one case to fifteen ounces. In all the others (nine in number) the arteries were in a diseased condition; and in seven cases there was evidence of concurrent disease in other organs.

Thus far these cases rather tend to confirm the observation of Paget in 1850—namely, that sudden death from apoplexy is most generally associated with fatty degeneration of the minute cerebral blood-vessels; while, at the same time, the associated morbid states of other organs are such as to lead to the belief of a more general morbid state, and perhaps more especially of the nervous matter—an apoplectic orgasm which predisposes to the extravasation of blood from diseased blood-vessels—the belief now most generally entertained regarding the nature of the apoplectic lesion.

Another interesting feature in the pathology of the lesions demonstrated to the Society is the organization of a wall round the extravasation, and the future changes of the blood-clot, as shown by its examination at various periods after the extravasation. Cysts existed in two of the cases, in one of which, on the thirteenth day after the seizure, the cyst was found nearly empty, the absorption having thus early taken place (MACINTYRE). On the other hand, again, at the end of twelve weeks, a portion of

coagulum still remained enclosed in a cyst, and blood-crystals existed in abundance on its walls (BRISTOWE). Even at a still longer interval bloody fluid has been found in a cyst otherwise nearly empty, as recorded by a French physician of the name of Moulin, who mentions such a morbid state existing seventeen years after the extravasation (SIEVEKING). The age of the clot may thus, in some measure, be indicated by the cyst, the condition of its contents, and especially as to blood-crystals. Virchow has recorded their existence in the cavity by the seventeenth day; and, as shown by Beale, they do not form from clotted blood until the blood-corpuscles become ruptured by endosmosis. The contents of the blood-cells then escape and crystallize, as the solution gradually becomes concentrated.

Symptoms.—Whatever may be the pathological doctrines taught regarding the morbid state of the cerebral parts in apoplectic states, we are able practically during life to do little more than merely to recognize the apoplectic state itself; the diagnosis between the congestive, the hæmorrhagic, and the serous or merely morbid nervous state can only be arrived at approximatively by a careful comparison of symptoms closely observed, such as are detailed in the treatise of Dr. Russell Reynolds already noticed, and from which the following statements are condensed:—

I. **Symptoms of Apoplexy from Congestion.**—The face, scalp, and conjunctivæ are increased in vascularity; the skin generally is of a dusky venous hue, and the surface is warm. There is fulness of the jugular veins, with increased pulsation in the carotids. The tongue is foul, and nausea prevails, with constipated bowels. Respiration and the pulse are both laboured, and the extremities are cold. Such are some of the general symptoms which indicate the approach of an attack of the congestive form of apoplexy.

The symptoms peculiar to the brain itself are,—

1. *Mental.*—The activity and power of the Intellect are diminished. General confusion of thought prevails, with deficient memory. Any attempt at mental exercise increases the expression of these signs; so does the recumbent position and emotional disturbance. Sleepiness, also, with laboured respiration, is common, especially after meals; and there is a general tendency to inaction of body as well as of mind—a "not-to-be-disturbed" sort of desire is experienced. Such mental phenomena, however,

are not permanent; and while there is a readily induced state of general confusion, there is no persistent, special, or permanent loss of power of Intellect.

2. *Sensorial.*—The senses generally are obtuse. The hearing is dull; and heavy rumbling noises are constant auditory illusions. The sight is dim, or *amaurosis* is complete, and often black or variously coloured spots are seen floating in the field of vision, or other spectral illusions are more or less constant. The patient may see only half of an object, or halves of objects of different colours. Vertigo is also present, with a sense of fulness and oppression in the head; numbness and weight of the limbs; dull and heavy *cephalalgia.* These symptoms, however, are only of occasional occurrence, and change their localities. While the absence of pain is not now considered of much diagnostic value, yet the occurrence of severe acute pain is generally indicative of something more than congestion.

3. *Motorial Symptoms.*—Little jerkings of the muscles, and irregular or sluggish movements of the eyeballs, are occasional. These precursory symptoms having generally been more intense for a few minutes or hours, an attack takes place, distinctly apoplectic. The seizure commonly occurs during some muscular exertion, such as lifting a heavy weight, pulling on a pair of boots, blowing the nose, straining at defecation, or the like; or even upon a simple change of posture, such as stooping, or suddenly assuming the erect attitude.

The special nervous symptoms of the attack in the *congestive form* are,—

1. *Mental.*—Some evidence of the existence of Perception may generally be obtained by loud noises, speaking to the person by name, or pinching him. If, however, Perception is quite extinct for a few seconds or minutes, it soon again partially returns, and there is confusion of Thought, with little Volition as to the direction either of Thought or movement.

2. *Sensorial.*—Except during the first few moments of the attack, when sensation generally is gone, the changes are slight. Sensation,—indicated at least by reflex action (the limbs being withdrawn if pinched),—is generally present.

3. *Motorial.*—There is more or less paralysis of all the limbs to a slight degree, and for a short time. It is very rare to have either hemiplegia or paraplegia. Short or involuntary evacuations

do not occur unless there have been some convulsions. There is no rigidity of the limbs, but clonic spasms are not unfrequent. Generally, and in the course of a few minutes, the symptoms begin to abate rapidly, and they rarely last even for an hour. With the return of consciousness paralysis disappears, and sensibility rarely remains deficient.

The manner of appearance and proportion between the three groups of nervous symptoms is of great diagnostic value. As indicative of *congestion,* rather than of *hæmorrhage* or *softening,* any one of the following combinations of groups of symptoms are of importance to be noticed:—

1. *The simultaneous development of the three groups of nervous symptoms. There being either—*

2. *Distinct loss of Perception, profound coma, and general paralysis, without rigidity or convulsion.*

3. *Imperfect loss of Perception, with general paralysis.*

4. *General paralysis, incomplete in degree, and sensation unimpaired, or but little affected;* or—

5. *Paralysis complete in degree, but without stertor or rigidity.*

II. **Symptoms of Apoplexy from Hæmorrhage.**—*A. Into the cerebral substance of the hemispheres.* Very different statements are made as to whether or not premonitory symptoms are present; and the practical point in diagnosis which such discrepancy of statements has taught is, "*that the non-existence of precursory symptoms in a given case is in favour of the belief that hæmorrhage rather than congestion is the cause of the lesion or softening.*"

The attack is generally sudden, and rapid in its development. Sometimes after a few hours there may be sudden aggravation of the symptoms, generally due to a renewed extravasation. The patient, if standing, generally falls instantaneously, as if knocked down. It is the nervous symptoms, however, which are of the most importance.

1. *Mental.*—Loss of Consciousness (of Volition and Perception) is commonly complete at the outset. For a few seconds at least the patient is utterly deprived of intellectual power, which in slight cases partially returns in a few minutes. In severe cases, however, Perception does not return till after some hours, and with vague ideas of things; expressions of Thought are confused, amounting to delirium; *and after the first few minutes or half*

hour has passed, the degree of intellectual obscuration may be taken as an approximate measure of the amount of extravasation, although it is to be remembered that there are some exceptional and rare cases on record of hæmorrhagic apoplexy in which the mental faculties were very slightly, if at all, impaired. After some days the Intellectual powers are often entirely restored; but in many cases confusion of Thought and partial loss of Memory remain. If the case does not terminate fatally, the well-marked character of the recovery is a strong presumption that the symptoms resulted from hæmorrhage, and were not due to softening of the cerebral substance.

2. *Sensorial.*—Sensibility is usually less commonly affected, and less intensely, than mobility. When cutaneous anæsthesia is complete, although the surface so affected may be limited in extent, the occurrence indicates severity of lesion. In slight cases there is generally only numbness and tingling of the tips of the fingers. Evidence of Sensation may be obtained when there is no proof of distinct Volition. During the profound coma of the attack at the commencement, the dilated pupil and the half-opened eye indicate that the retina has lost its impressibility; and if hearing and smell are similarly affected, the persistence of such symptoms are signs of evil omen.

3. *Motorial.—Paralysis* is present in the immense majority of cases, its characteristic form being *hemiplegia;* but sometimes it is general, the proportion of cases being as ·84 to ·16 *per cent.;* and when the paralysis is general, the hæmorrhage is rarely limited to the substance of the hemispheres. During profound stupor the deviation of the face indicates paralysis on one side. In less severe cases the condition of the limbs as to Volition is the guide. The tongue commonly deviates to the paralyzed side; and any extreme movement of the face, such as crying or laughing, renders the inequality of action more apparent. The *orbicularis oculi* generally escapes paralysis, or is less affected than the other facial muscles. The loss of motion is commonly absolute at first, especially in the arm, which is generally more profoundly affected than the leg, the one being more completely paralyzed than the other. Stertor, with involuntary defecation and micturition, are common. *Involuntary contractions* of a tonic or clonic kind are extremely rare from hæmorrhage limited to the cerebral substance.

The more common combinations of symptoms by which the existence of cerebral hæmorrhage limited to the medullary substance might be inferred are—

1. *Profound coma, with hemiplegia on one side, of marked intensity, and without rigidity.*

2. *Paralysis of both sides, but one more profoundly affected than the other—a rare occurrence in limited hæmorrhage.*

3. *Slight coma, but paralysis hemiplegic and complete.*

B. Hæmorrhage into the Ventricles cannot in some cases be distinguished from arachnoid extravasation, or in others from effusion into the cerebral substance only, especially when in the vicinity of the ventricles. The cases, however, which are less doubtful are marked by the following characteristics, in addition to the general signs of apoplexy:—

1. *The Mental State.*—Coma is very profoundly marked at the commencement, and remains of equal intensity; or the patient, after partially recovering from a slight seizure, is again suddenly plunged into profound coma, from which there is no recovery. This second attack is presumed to indicate the rupture of the hæmorrhage either into the ventricles or the arachnoid cavity, from its original site of extravasation in the medullary substance of the brain near the ventricles or near the surface.

2. *Motorial Symptoms.—Paralysis* is complete in degree, and is developed simultaneously on both sides; or after having been hemiplegic for a short time it becomes general; when the coma of the second attack above noticed comes on, stertorous breathing is strongly marked. Involuntary evacuations follow. The pupils remain dilated. Deglutition is dangerous and difficult. When the paralysis is general and the coma profound, it is almost a sure sign that hæmorrhage has taken place to a considerable extent into the ventricles. *Rigidity* or *tonic contraction* of the muscles is present in many cases of hæmorrhage, and in nineteen out of twenty-six cases occurs in the paralyzed limbs; and in about four out of twenty-six cases may be seen in those of the healthy side (Dr. Russell Reynolds). Its presence is a sign of extensive hæmorrhage, with laceration of the brain. The most frequent combination of symptoms indicative of hæmorrhage into the ventricles may be shortly stated to be *profound coma, with general paralysis and rigidity.*

C. Arachnoid Hæmorrhage occurs when the extravasation

bursts through the pia mater and arachnoid into the space between the membranes, and such cannot be distinguished from the *ventricular extravasation* just noticed. If, however, the extravasation is immediately subarachnoid at first, and of limited extent, it may be approximately diagnosed,—*First*, By the nature of the premonitory symptoms having partaken of meningeal inflammation, such as by severe pain in the head, with impaired Intelligence and power of movement. *Second*, The attack is less sudden than in cases of congestion or of central hæmorrhage, and the symptoms are progressively developed.

The following are the combinations of symptoms which indicate the occurrence of subarachnoid hæmorrhage:—

(1.) *Complete and profound coma without paralysis; or with general paralysis very slightly developed in intensity.* (2.) *Complete loss of consciousness without paralysis; but combined with rigidity or clonic contractions of the limbs.* (3.) *Paralysis of hemiplegic distribution as regards the limbs, but without deviation of the features, the muscles of the face not being implicated.* (4.) *An apoplectic attack without anæsthesia.* (5.) *Imperfectly developed coma with general paralysis.* (6.) *An apoplectic attack, of which the symptoms are somewhat interchangeable or remittent.*

Causes.—Among the most frequent causes of apoplexy, especially in some constitutions, is an intemperate use of fermented liquors—a class of substances which powerfully excites, mainly by inducing paralysis of functions, which allows the evidence of excitement to appear as the prominent phenomena (ANSTIE). Alcohol also acts specifically on the heart and arteries, causing not only temporary energetic action of those parts, but also organic alterations in their structure, (Vol. i., p. 830, *et seq.*) In the latter case the powers of the heart are often permanently augmented, while the coats of the arteries, thickened, thinned, or ulcerated, have their elasticity destroyed, and thus the tendency to hæmorrhage in the brain is increased. The excessive use of narcotics, as opium or tobacco, is also supposed to predispose to congestion of the brain, and consequently to cerebral hæmorrhage.

The following conclusions have now been arrived at from a comprehensive view of numerous cases:—(1.) That in by far the greater number of cases cerebral hæmorrhage is due to degenerations of the cerebral arteries as its predisposing cause. In the

smaller arteries these consist of fatty metamorphosis, or simple atrophy, with the various forms of consecutive dilatation; while in the larger arteries of the base there is *arteritis*, issuing in ossification, or fatty degeneration, or passive calcification. (2.) A not entirely rare cause are true aneurisms of the large cerebral arteries. (3.) Hypertrophy of the left ventricle will only favour cerebral hæmorrhage when it permanently increases the normal tension of the aortal system; but this is not the case in compensating hypertrophy of valvular disease of the heart. (4.) In about one-seventh of all cases of apoplexy, neither predisposing diseases of the heart nor of the vessels could be demonstrated (EULENBERG in Virchow's *Archiv.*, vol. xxiv., p. 329; and *Syden. Soc. Year-Book* for 1862, p. 81).

The connection of apoplexy with advanced disease of the kidney has occasionally attracted the attention of pathologists; and the late Dr. S. Kirkes recently brought forward some facts in proof of the frequency with which the kidneys are found diseased in fatal cases of apoplexy; and which, to a certain extent, explain the connection between the renal and cerebral affections (*Med. Times and Gazette*, 1835, p. 515). In all the cases except one the heart was found enlarged—an enlargement due to the prolonged disease of the kidney—and generally in the form of hypertrophy of the left ventricle, without valvular disease. The primary disease is that of the kidney; then the heart and then the blood-vessels become diseased in consequence of the primary affection. The disease of the blood-vessels is chiefly in the form of the well-known yellowish-white thickening and deposit within the coats of the blood-vessels; and Dr. Kirkes believed that the disease of the vessels is in a great measure the result of the continual over-distension and straining to which the arteries are subjected by the unwonted energy with which an hypertrophied heart propels the blood along them:—the full force of the hypertrophied ventricle, independent of valvular disease, will be exercised upon the arterial current.

Extremes of temperature are likewise powerful predisponents to apoplexy. In summer the fluids of the body tend to produce turgidity of the vessels in some constitutions, and the tone of the capillaries is impaired; while in winter the cold drives the blood from the periphery of the body to its central organs, and consequently to the brain. Sudden and great vicissitudes of the

weather, as they rapidly exhaust the nervous power, are more frequently fatal than the uniform continuance of its extremes.

The powerful effects of *moral causes* in producing this fatal disorder are well known. *Mechanical obstruction* is also a frequent occasion of apoplexy. If an obstacle, for example, be opposed to the course of the blood, as when the valves of the heart are diseased, the blood accumulates in the capillary system generally, and consequently in the brain; or errant clots of fibrin choke up the minute cerebral vessels. Apoplexy is still more common when the aorta is diseased, the force of the heart, unchecked by the elasticity of that vessel, acting directly on the brain, so that its vessels often give way from this cause. *Mechanical violence*, also, often produces apoplectic effusion. Thus, concussion of the brain, however slight, always produces more or less congestion of that organ; and, if severe, effusion may take place below the *dura mater*, or between the membranes, or into the substance of the brain, which may be extensively ruptured.

Apoplexy has been known to occur even in childhood. Billard gives the case of a child three days old that died apoplectic from effusion into the left hemisphere and about the lateral parts of the *corpora striata*. Serres saw a similar case in a child three months old. Apoplexy, however, is extremely rare till puberty, and only a few cases are met with before twenty. It is not unfrequent between thirty and fifty, while after fifty it is one of the most frequent causes of death. There are many circumstances which favour the disposition to apoplexy in old age. At that period the capillary system becomes impaired in most organs, and thus the veins are filled with a greater quantity of blood, or they become congested. The cerebral arteries also are often diseased; the heart has frequently acquired an abnormal power, driving the blood with great violence, and with an increased momentum, towards the brain, while the lungs have their functions so impaired that the blood is only imperfectly oxygenated; and all these are causes of congestion, and of tendency to rupture of the vessels of the brain.

Both sexes are liable to this affection, and in nearly equal proportion. Those most liable to attack are the florid in complexion, of short-necked conformation, with prominent eyes, broad chests, and protuberant bellies, and sometimes enormously fat, espe-

cially if high livers, sedentary, and indolent. Many thin persons, with spare long necks, however, frequently die from apoplexy; but it is probable that in these cases the heart or large vessels have been diseased.

The act of digestion, or rather fulness of the stomach, appears to predispose to apoplexy. Numbers are attacked after dinner. Sleep, also, associated with a temporary congestion of the vessels of the brain, is another predisposing circumstance. Thus, of 176 cases examined by Gendrin, 97 had been attacked during sleep. In the sleep of a healthy person the brain is anæmic (DURHAM).

Many diseases, or conditions of the body, predispose to apoplexy, as mania, epilepsy, suppressed hæmorrhoids, amenorrhœa, and especially the "*turn or change of life.*"

Prognosis.—Apoplexy is always a grave disease, and the more grave in proportion, generally, as the respiration is stertorous and the deglutition difficult. Each succeeding attack is more dangerous than the former. The practitioner should also be guarded in his prognosis till after the first week or ten days, lest inflammation should come on, or a fresh attack destroy the patient. Popular opinion (and it is useful in pronouncing an opinion to know what are popular beliefs) supposes the patient to suffer three apoplectic attacks, the first being mild, the second followed by paralysis, while the third is fatal. It is only in a few instances that this number is exceeded.

In the congestive form of apoplexy, if active and judicious measures of treatment are employed, the recovery may be rapid and complete; but if this is not the case, there is a liability to a more aggravated form, from which nothing is more variable than the time of recovery. In a very few instances the patient is restored in a few days, or in a few weeks, or in a few months, but more commonly the lesions of motion are permanent, or nearly so. In general, however, some slight improvement takes place even in the worst cases, so that the patient recovers some use, first of his leg, and then, perhaps, of his arm, so that he is able to walk with a "straight leg" and a dragging foot. The use of his arm returns more slowly and more imperfectly. This recovery is often preceded and accompanied by very severe pains, especially of the upper extremity, marking the still irritated state of the brain. The limb, however, uniformly wastes, and its vital powers are so impaired that, if inflamed, the inflammation seldom

terminates by resolution, but has a great tendency to gangrene, while cicatrization is slow and difficult.

The commonest occurrence is the perfect recovery of the mental faculty, and the progressive but much more gradual return of motion and sensibility. Paralysis of motion sometimes persists in groups of muscles, such as those of the tongue, the forearm, or hand. Sensibility is generally first restored, then the motion of the lower extremity, then the arm, and lastly that of the forearm and hand. Discordant opinions are entertained relative to the influence of the electric structures on the paralyzed muscles. The late Dr. Marshall Hall was of opinion that the muscles of the non-paralyzed limb were the more irritable. The late Dr. R. B. Todd entertained precisely the reverse opinion. These were the highest authorities of their day in this country. Duchenne draws attention to two conditions of paralysis after apoplexy—namely, one directly dependent on the central lesion, the other the mere result of inaction for some time. In the former case there is contraction of the muscle as the result of increased spinal action, uncontrolled by the central ganglia of the brain—in the latter form the muscles are flaccid. Active tonic contraction of the muscles, distinct from simple shortening of the flexors, he considers as indicating inflammatory action in the walls of the cyst; but this distinction is one which requires corroboration or contradiction by subsequent observation (Dr. Russell Reynolds).

No doubt the principal adverse circumstances attending recovery from apoplexy are, that although the patient appears to be doing well the first few days after the attack, yet towards the close of the first week the brain, irritated by the presence of the clot, inflames and softens, and thus induces another and a fatal attack of apoplexy. Should the patient, however, survive this dangerous period, he may continue to live many months, or years, according to his age; but he is generally at length cut off by a fresh attack of apoplexy, or his brain ultimately inflames and softens, and he dies in a typhoid state, as already described.

Although it is the general rule that the patient, on recovering from the attack, has the good fortune to recover all the faculties of his mind, yet his Memory is not unfrequently impaired, often to such a degree that he has forgotten all dates, the names of his

friends, or even the names of things. Broussonet, Professor of Medicine at Montpellier, had entirely lost the remembrance of all substantive nouns, and another case is on record in which the patient lost the recollection of all his adjectives. In some instances the power of association is also so destroyed that although many remember both names and things, they are unable to connect the thing with the proper word, so that they call that which is cold, hot; or speak of night when they mean day; or call a coffee-pot a wash-hand basin. Others, again, have forgotten how to read, and the power thus lost either returns suddenly, or they are obliged to learn *de novo*.

The attention generally is very greatly impaired, and the patient is no longer able to transact business; or if he begins a sentence, is unable to finish it, or he repeats the same idea over and over again. The passions also are little under control, for while some weep like children, others laugh immoderately, and all are easily terrified, or otherwise easily influenced.

All these circumstances must be remembered in giving a prognosis regarding an apoplectic patient.

Treatment.—The patient, if seen during the fit, may be bled if the tendency to death is by *coma*, and if the pulse be full, or hard, or thrilling; if the vessels of the neck be congested, the heat of the scalp increased, and if the face be full and turgid. The state of the heart ought to be examined into first. If its action be vigorous, its sounds normal, and the heat of the skin preserved, blood-letting is still more required. Slow and deep respiratory movements, with stertor, add greatly to the necessity of immediate venesection; and the beneficial action of the remedy is shown by the pulse becoming fuller, stronger, and more regular; and the bleeding may be allowed to proceed till an obvious impression of this kind is made, or until the pulse begins to flag. Large bleedings are to be avoided. Ten ounces will generally be sufficient, if taken at the first outset of the attack; but if the pulse does not improve, and other symptoms remain unrelieved, sixteen to twenty ounces may be taken. The indications for blood-letting being thus strongly pronounced, "we ought not to hesitate to open a vein, regardless of the age of our patient" (MACLACHLAN). The bleeding ought to be permitted to flow from a large opening, in order to relieve the congestion, to check, if possible, a further effusion of blood, and to divert its active flow

from the head. The quantity taken should be proportioned to the degree of stertor, and to the powers of the patient. The head and shoulders should be raised while the blood is flowing. But, on the contrary, if the pulse be small and slow, feeble, or almost imperceptible, the skin cold and clammy, with a tendency to death by syncope, then no advantage is to be gained by the abstraction of blood at this time and in this way. Blood-letting is therefore contra-indicated under the following circumstances:—(*a.*) anæmia, (*b.*) aortic valvular disease, (*c.*) in cases commencing with syncope.

If the blood-letting is not followed by some degree of consciousness, it may be inferred that the amount of blood effused is considerable, and that the patient in all probability will not recover. Still, perhaps, an additional chance may be given by applying to the head cold cloths, or crushed ice in a bladder, leeches to the temples, and mustard cataplasms to the feet; also by placing a drop or two of croton oil on the tongue, and by throwing up a cathartic enema of castor oil or other purgative. At one time every case of apoplexy was treated by blood-letting; and statistics prove, of such indiscriminate practice, that the more freely the blood was taken away the greater was the mortality (Copman). Some Physicians are opposed to any considerable bleeding during the fit, considering that the bony structure which contains the brain removes all atmospheric pressure so entirely as to cause that organ at all times to contain an equal quantity of blood. A space within the head for a very sensible expansion and contraction at each pulsation of the heart is opposed to such a belief, while *post-mortem* examination shows the brain to contain very different quantities of blood, being sometimes gorged and sometimes blanched of that fluid. These facts distinctly show that some arrangement exists for regulating the quantity of blood sent to the brain; and we ought, therefore, in a disease of this moment, to follow the dictates of a long experience, rather than the conclusions of a fallacious reasoning.

When emetics are now spoken of, it is generally with the view of condemning them. The physiological phenomena which attend their action increase the determination of blood to the head, as is now well known; and the action of vomiting may be fatal in such cases. After the patient has in some degree revived, and the congestion removed, some time for the absorption of the

blood effused should be allowed before deciding upon the future treatment. Any very large depletion after that point is gained would rather facilitate extravasation than prevent it. A few hours, then, having elapsed, the conduct of the practitioner should be guided by the occurrence or not in the patient of *pain of the head*, which may be taken as a measure of the fulness of the brain, and its tendency to inflammation. If, therefore, there be pain in the head, ten to twelve leeches should be applied from time to time till that symptom is entirely relieved; or, supposing the pulse to be full and strong, and the patient free from headache, yet, under these circumstances, leeches should be applied to the head, to subdue that re-action which so generally takes place from the fourth to the seventh day.

The further treatment of the case is by moderately purging the patient, both as a means of relieving the head and of improving the secretions of the alimentary canal, which are often black and fetid. Active purgatives generally do good. Five grains of *calomel*, with a drachm of *compound jalap powder*, given as soon as the patient can swallow, and followed up by *black draught*, or by an ounce of *sulphate of magnesia* with *camphor mixture* every four or six hours, and continued, according to its effects, for a greater or less length of time, are the best means we have for promoting recovery, and for preventing a relapse. These prescriptions are recommended on the supposition that the attack has been associated with simple plethora. In many cases, however, it is a consequence of hypertrophy of the heart, without valvular disease. And in such cases less blood should be taken, and eight to ten minims of *digitalis* may be added to each dose of the purgative medicine. If the power of swallowing is in abeyance, then three or four drops of croton oil should be put on the back part of the tongue, and stimulating enemata thrown up the rectum. The following are recommended by Dr. Tanner:—

1. *Enema of Turpentine and Castor Oil.*—℞. Olei Ricini, Olei Terebinthinæ, ā ā ℥iss.; Tincturæ Asafœtidæ, ℥ii.; Decocti Avenæ, ℥xii.; *misce*, fiat enema. To be thrown up the rectum by means of a long stomach-pump tube.

2. *Croton Oil Enema.*—℞. Olei Ricini, Olei Terebinthinæ, ā ā ℥i.; Olei Crotonis, ♏vi.; Decocti Avenæ, ℥iv.; *misce*, fiat enema.

Although turpentine is objected to by some, on account of the

intoxicating effects which it is sometimes apt to produce, it is nevertheless an efficient remedy where torpor and insensibility exist. It is of great importance to empty the rectum and lower bowel. In cases where the ability to swallow is lost, a drop or two of croton oil with five grains of calomel, rubbed up with fresh butter, may be laid on the back of the tongue.

If the intestines are distended by gases, an enema of castor oil and rue may be given:—

3. *Castor Oil and Rue Enema.*—℞. Confectionis Rutæ, ʒi.; Olei Ricini, ʒi.; Tincturæ Asafœtidæ, ʒii.; Decocti Avenæ, ℥vii.; *misce* (*Practice of Medicine*, 4th edition, p. 653).

All apprehension of a relapse being at an end, the patient is in general most willing to believe that the palsy which may remain is a mere local disease, and to submit to any treatment for its removal. The ancients applied the actual cautery to the extremities, to the coronal suture, or to the occiput, but without any beneficial success. The moderns have had recourse to blisters, to friction, to electricity, and to strychnine; but every attempt to act locally on the muscular system is prejudicial so long as any central irritation exists. (See "Paralysis.") Active or passive exercise of the muscles are remedies highly beneficial.

Dietetic Treatment.—The diet of the patient should be low, till all apprehension of a relapse is past, and limited to milk, boiled vegetables, light puddings, and fish. At no subsequent period ought he to indulge in a full animal diet, or to drink undiluted wines. At the same time, too lowering a regimen is to be avoided, as thereby the irritability of the system and the heart's action generally is increased. All the causes of the disease already fully referred to should be avoided, counteracted, or overcome.

HÆMATOMA OF THE DURA MATER.

Definition.—*Sanguineous flattened masses composed of fine layers of fibrin spread to a greater or less extent over the dura mater, accompanied by small extravasations which are converted into pigment. By repetition of the process numerous layers come to be deposited one upon the other. Numerous and large blood-vessels form in these layers; and from these vessels renewals of the*

hæmorrhage occur. The disease is chronic, and terminates, after continued cephalic suffering, generally suddenly, with symptoms of apoplexy.

Pathology.—These tumors of bloody formation seem to occur in connection with more or less inflammation of the *dura mater*. The effusion of blood between the *dura mater* and the arachnoid is not in most cases a primary occurrence, but the productive results of inflammation first occur; and the new growth is developed into a fibrous membrane traversed by a copious network of new-formed blood-vessels. It is from the rupture of these vessels that extravasations proceed (VIRCHOW, WEBER). The lesion is sometimes described as due to *intra-meningeal* apoplexy, with false membranes on the *dura mater;* but the false membranes which are the result of the chronic inflammation precede the apoplectic phenomena. The *hæmatoma* often attains a considerable size. It may be from four to five inches long by two and a half inches broad and one half to three quarters of an inch thick. It is generally of a flattened circular form, with a central elevation. The long diameter is parallel to the falciform process. The tumor generally occurs on one side only; or, if bilateral, one is more developed than the other. The affection appears to occur only in the adult, and generally after the age of fifty. In recent cases very fine layers of fibrin are found to a greater or less extent spread over the surface of the *dura mater*. By repetition of the inflammatory process, numerous layers of fibrin become deposited one upon the other; and much more numerous and larger blood-vessels form in these layers than are to be met with in the *dura mater* itself. From these new-formed vessels the hæmorrhage proceeds which gives rise to the formation of the *hæmatoma*, and its cystic enclosure is formed by the extravasation taking place between the layers of the false membrane (VIRCHOW).

Symptoms may extend over several months, and consist in general weakening of the Memory and of the Intelligence; the occurrence of giddiness; and of continuously intermittent general or local pain in the head. At a later period an aggravation of all these phenomena occurs, with transitory losses of consciousness from the momentary arrest of cerebral circulation. Somnolence and apathy prevail, with weakness, and generally one-sided paralysis of the extremities, which may soon disappear.

Treatment—Is more or less expectant. The newly formed membranes tend to undergo retrograde change, and thus finally disappear. To effect this end is therefore the object of any rational treatment, which must be based on the special history of the individual case, especially as to the previous existence or not of syphilis.

Section III.—General Diseases of the Nervous System characterized by Exalted, Perverted, or Suspended Functional Activity.

This group may be illustrated by the diseases known as *chorea, epilepsy, hydrocephalus, insolatio,* and *insanity.*

CHOREA—Syn., ST. VITUS'S DANCE.

Latin, *Chorea;* French, *Chorée;* German, *Veitztanz*—Syn., *Chorea;* Italian, *Corea.*

Definition.—*An irregular convulsive action of the voluntary muscles, of a clonic kind, especially of the face and extremities, they being either entirely withdrawn from the control of Volition, or but little under the direction of the Will.*

Pathology.—The history of this disease is a sad picture of superstition. As late as the close of the fifteenth century it does not appear to have been studied by physicians, but was supposed to depend on supernatural causes or "demoniacal possession." In Germany it was said for two centuries to have been epidemic, and the patients, probably many of them maniacs, were wont to join in frantic dances; and as late as 1673 they went in procession to the church of some favourite saint, of whom St. John, St. Guy, and St. Vitus were the most reputed. Hence the name of St. Vitus's Dance, by which the disease is sometimes described. As physical remedies were supposed to be unavailing in such a disorder, the priests said masses, sung hymns, and sought by such means to exorcise the foul fiend.

The morbid appearances of the body which have been observed in cases of chorea have not as yet thrown much light on its pathology. Sydenham, Cullen, Rostan, Bright, Stoll, Pinel, and others, who have had frequent opportunities of examining cases of this disease, failed to detect any other morbid appearances than

those which were commonly seen in other affections of the brain and spinal cord. Accordingly many various pathological views are entertained regarding this disease, which may be classed as follows:—(1.) By some pathologists it has been regarded as a disorder entirely functional or dynamic, and independent of organic change. (2.) It is also believed by some, and not without good reason, that the blood, at all events in some cases, is primarily diseased, or becomes so constitutionally, the precise nature of the change being as yet unknown. (3.) Associated with some other diseases, whose pathology is better known, it has been regarded either as a concomitant feature, or as a necessary consequence of their previous existence: such, for instance, as *rheumatism*, and *diseases of the heart.*

Much evidence has been brought forward in favour of the humoral or rheumatic character of the disorder. Dr. Copland has the merit of having been the first to indicate the complication of chorea with that class of diseases, (*London Medical Repository*, vol. xv.) His views have been subsequently confirmed by Drs. Prichard and Roeser, and more recently by the elaborate researches of Dr. Begbie and Dr. See. Numerous instances have also been adduced by Andral, Bouillaud, Bright, Mackintosh, Watson, R. B. Todd, Kirkes, and others, in which diseased conditions of the heart and pericardium have been attended with, or have given rise to, spasmodic diseases of the nature of *chorea, paralysis, mania,* or *dementia;* and the evidence of these writers is amply sufficient to prove that a considerable number of individuals affected with *chorea* have suffered from *cardiac* or *synovial rheumatism* previously. Dr. Sidney Ringer has observed one or two cases of chorea with considerable elevation of the temperature, but without any of the ordinary evidences of *rheumatism.* He believes such cases may tend to show that even in those in whom there has been no evidence of previous rheumatism, it nevertheless probably existed, but was latent in respect of all the symptoms except elevation of the temperature. But it is unquestionable that all have not so suffered; and, indeed, the history of the majority of the cases clearly shows that chorea has a more intimate connection with mental disease, such as imbecility, or even insanity, than with perhaps any other morbid state. The presumed blood-condition, similiar to that which exists in *rheumatism*, can only thus

be regarded as one of many occasional causes, the real essence of the disease being a perverted nervous function, as Dr. Reynolds writes, and with whose remarks I am pleased to find the views here stated agree.

Cardiac affections are apt to supervene in cases of chorea, differing in kind as well as in degree, namely,—(1.) Rheumatic endocarditis, or pericarditis, resulting in organic change; (2.) Functional derangement and cardiac murmurs, due to an impoverished condition of the blood (ROMBERG); (3.) A chronic affection of the heart itself, "evidenced by the existence of a systolic murmur at the left apex, which cannot be referred to inflammation or organic change of the mitral valve, which has not the usual accompaniments of a hæmic murmur, but which does seem plausibly ascribable to disordered action of the muscular apparatus connected with the valve" (WALSHE).

As in the case of most diseases expressed during life merely by perverted functional activity, morbid anatomy is often at fault. Our means and appliances for the accurate appreciation of nervous lesions especially are but rude compared with the fine and delicate textures with which we have to deal. When patients suffering from chorea have died, and the brain has been carefully examined, the most experienced observers have failed to detect any lesions by which the occurrence of the symptoms could be explained. This negative evidence no doubt points to some morbid condition of the blood as an essential element in chorea. Rostan had once an opportunity of examining a woman upwards of fifty, and who, from her childhood, had laboured under chorea of the whole of the left side of the body, and of which the limbs were atrophied. "I expected to find," he says, "atrophy of the right side of the brain, but there was nothing morbid; at least, after a most careful examination, I could see nothing." Dr. Bright has given one case which he had an opportunity of examining, and which gives equally negative results. It was that of a young woman aged seventeen, who had formerly laboured under this disease. She had been free from it for four years, when she formed an attachment, was forsaken, was attacked with chorea, and died. The attack was of great severity; she tossed herself about in all directions, bit her tongue, and was with difficulty in any degree controlled. On examination, there was a slight effusion into the arachnoid cavity, more *puncta*

cruenta than usual, and five or six bony plates opposite the *cauda equina*—phenomena common in many diseases of the brain or cord, and of course incapable of having any pathological significance assigned to them in relation to chorea. It is equally impossible to fix upon any other organ or part of the body in which anything like constant structural lesions have been observed, susceptible of being associated in explaining the nature of chorea. The structures which most obviously manifest disordered action during life are the nerves and muscles; and for the following reasons we are led to believe that they are maintained in their disturbed and excited state by some morbid condition of the central parts of the brain, and not of the spinal cord, either directly or by reflex action.

1. *Clonic spasm*, of the incessantly repeated character peculiar to chorea, is not a phenomenon of persistent spinal irritation; while *tonic spasm* is a mark of such a condition (REYNOLDS).

2. The movements can generally be in some measure controlled by the Will, unless they are very severe; and even then they are so controlled to some extent (REYNOLDS).

3. The spasmodic contractions cease during sleep, whereas phenomena of an excito-motor character are increased by the removal of Volition. Fixing the attention also to some other object likewise diminishes the intensity of choreic movement (REYNOLDS).

4. The special occasions of increase or of induction of choreic movements are the attempts at volitional action and emotional changes (REYNOLDS).

5. The phenomena of chorea during life, in accordance with the views expressed by Drs. R. B. Todd and Carpenter, which are now very generally received, tend to refer the exciting cause of the disease to changes going on in the central ganglia of the brain, such changes being expressed in a healthy state through "Volition, Perception, or Emotion, or the balancing and co-ordinating of movements."

6. Experiments on living animals, and observations in morbid anatomy, tend to prove that injury to the *optic thalami* is productive of considerable disturbance to the movements of the body.

7. An opportunity was afforded me, when Pathologist to the Glasgow Royal Infirmary, of examining carefully a case of chorea,

which terminated fatally after a most violent attack, the acute symptoms lasting ten days. The result of the examination showed some decided changes in the *corpora striata* and *optic thalami*, sufficiently indicated by the following observations:—

"The specific gravity of the *corpora striata* and *thalami optici* was different on the two sides of the brain: those on the right side were of the specific gravity of 1·025, those on the left side of 1·031; and this difference appeared from the hydrostatic experiments, as well as from those made with the gravimeter, confirming in some measure the accuracy of the general result.

"The vascularity also of these central parts of the brain, when compared with the grey matter of the spinal cord, which was healthy, was so well marked as to leave no doubt of its abnormal increase.

"Microscopic examination confirmed the existence of increased vascularity, for numerous capillary vessels, in unusual abundance, existed in every section examined. Some of these were irregularly dilated, as in a varicose condition, and were filled to a greater or less extent with the red corpuscles of the blood. The amount of granular substance in these parts of the brain, on both sides, appeared to be greater in proportion to the fibrous substance than in the same parts of healthy brain with which I compared them" ("Contributions to Pathology," *Glasgow Med. Journal*, No. I., 1853).

The late Dr. R. B. Todd remarked that "further observations on this subject are greatly needed, and will no doubt throw great light on the pathology of chorea and other allied affections."

Dr. Walshe, the Emeritus Professor of Medicine of University College, was the first to call attention to a not unfrequent occurrence in the course of chorea—namely, a high specific gravity of the urine. The high density of the urine is most marked where the choreic movements are most active; and no doubt it indicates increased waste of tissue, consequent on the disturbed state of the muscles and nerves (*Lancet*, Jan. 27, 1849, p. 85). In the acute case of chorea so carefully recorded by Dr. Walshe, four phases were observed in the characters of the urinary discharge, namely,—During the first five days it was "*febrile;*" that is, of high specific gravity, deep brownish-gold colour, strong urinous odour, and depositing lithates in abundance. *Second*, There came a period during which a great excess of urea gave a special character to the fluid, while alternating improvement and recrudescence marked the course of the chorea. This superabundance of urea

is, in the present state of our knowledge, referred to the muscular waste entailed by the constant convulsive movements. *Next*, there appeared oxalates in the urine passed on the twenty-sixth day, on which day the improvement in the case was so marked that the child might have been considered convalescent. *Subsequently*, an abundant precipitation of phosphates took place, the indubitable result of previous nervous waste.

These observations, originally made by Dr. Walshe, were subsequently confirmed by the late Dr. Todd, and by Dr. Bence Jones.

In a case recorded in his most interesting *Clinical Lectures on Paralysis, Disease of the Brain, and other Affections of the Nervous System*, where the urine was carefully examined from day to day by Dr. Todd, the density of the urine was shown never to have fallen below 1·019, and frequently reached 1·030, and once was found as high as 1·035. As the patient improved in health, the urine fell in specific gravity, but was never below 1·019. Lithate of ammonia was nearly always present, and oxalate of lime was frequently found mixed with it. An excess of urea was also frequently present. In another case he records the specific gravity of the urine as ranging between 1·030 and 1·040, and afterwards falling to 1·020 and 1·022. Generally speaking, he found the density of the urine highest in those cases in which the movements were most general and most active, and falling steadily with their diminution, and with the restoration of a greater controlling power on the part of the patient.

Symptoms.—Chorea principally consists in singular and involuntary movements of one or more limbs, which prevent the patient from being able to lay hold with certainty of any given thing, or to carry that object, be it a spoon or a glass, with any certainty to his mouth, or to any other place. These symptoms are developed gradually, reach a certain point of intensity, remain at such a point for a variable period, and it is often a long time before they subside, and all traces of them disappear. Premonitory symptoms are neither frequent nor characteristic; but a certain susceptibility to nervous disturbance, and irascibility of temper, are not uncommon. General ill-health is not unfrequent, arising from various causes, as delay of menstruation, and constitutional morbid states, such as rheumatism, or the existence of some zymotic disease. The commencement of the symptoms is

often at first insidious, but more commonly gradual, and sometimes sudden. They consist at first simply of restlessness, or of hurried and somewhat clumsy movements. The left side and the upper limbs are frequently affected first; but subsequently the whole body is involved. The lower limbs are generally as much affected as the upper, and the patient can with difficulty walk in a straight line, or if he does, it is always by a series of movements which tend towards the object, counteracted by another series which altogether diverge from it,—his feet turning in and out, upwards and downwards, in every possible direction. The muscles of the face and neck are sometimes seized with this species of convulsion, when the head is not only tossed about, and the mouth contorted into the most singular grimaces, but it may require two or three persons to feed him—one or more to hold him, and another to watch the proper moment to pop the food into his mouth. Sometimes the motor nerves of the fifth pair are affected, and then the jaw closes with a loud snap, or the articulation of voice is affected, or the effort of swallowing difficult.

Thus the essential phenomena of chorea are motorial, consisting of spasmodic involuntary contractions of the muscles, which have been thus classified by Dr. Reynolds:—(1.) *Clonic Spasms;* of great frequency, unattended by pain, resembling the restless movements of a child who has been irritated or put out of temper. Such spasms occur independently of any attempt at voluntary movements, and are in slight cases almost unobserved. (2.) The patient is agitated by all sorts of odd motions, and has often a vacancy of countenance which gives him a fatuous appearance. These symptoms are constant during the day, but during sleep they generally cease altogether. They affect both sides, as a rule, and in a very few cases one side only. The patient is then said to labour under *hemichorea.* The child's health is generally good; his pulse natural; and his bowels, though occasionally constipated, are by no means uniformly so, but for the most part act regularly. The spasms are generally increased by Emotion, and, while they persist during the day, disappear during sleep. The heart acts regularly, probably owing to the anæmic state generally associated with chorea. Dr. Addison describes a bellows murmur, often mitral, but sometimes aortic, and probably due to the same cause.

Causes.—The disease frequently attacks children otherwise in

good health, and without any obvious cause. When any cause is assigned, it is usually terror. Somebody has pretended to cut off the child's head, and perhaps has drawn the back of a knife across the throat; or a person dressed in a white sheet has personified an apparition. The symptoms have been known to follow the fright in a day or two, at other times about three or even six weeks have elapsed before the disease became manifest. The causes producing this affection, however, are generally referred to mental impressions. A woman in the fourth month of her pregnancy had a frightfully disgusting object thrown at her bosom. She continued for two months in a state of extreme nervous illness from this circumstance, but recovered, and went her full time, remarking, however, that the child was extraordinarily lively in the womb, and that she was often overcome with the sensations it produced. At birth, the child (a girl) displayed the writhing motions of chorea, and continued to suffer throughout life. When she was about thirty years of age she had the appearance of an elderly child, with a head remarkably small, and a mind hardly removed from complete idiocy (MAYO).

Chorea is limited, or nearly so, to early life, and is rarely seen after twenty. Dr. Heberden states it to be most frequent between the ages of ten and fourteen, and also that it is more common in the female than in the male, three-fourths of the patients under his care having been females. Dr. Rufz regards the ages from five years to fifteen as the most liable to chorea; and that girls are three times more frequently sufferers than boys. Dr. Todd's experience shows that chorea generally occurs between nine and fifteen years of age. It is really a disease of childhood; and although symptoms somewhat resembling those of chorea are sometimes seen at the adult period of life, and at more advanced ages, still such cases are exceptional; and it may be questioned whether they are due to exactly the same morbid condition as that which gives rise to the ordinary clonic convulsions of early life. The probable influence of the rheumatic constitutional state, or of some other unknown constitutional diathetic condition, has been already noticed.

Prognosis.—The recovery of the patient, with very few exceptions, may be always prognosticated. The disease will in general gradually decline, with complete removal of the spasms. The mean residence in hospital for cases of chorea has been found to

be thirty-one days (Rufz). Those cases only are apt to terminate fatally which occur during an attack of rheumatism or pericarditis, or when the disease assumes an intensely acute form, the patient losing rest at night and becoming exhausted; then emaciation progresses rapidly, and death occurs in from nine to twenty days. (See account of such a case by Dr. Wm. Weir, in *Glasgow Medical Journal*, No. I., 1853.) Dr. Walshe's experience leads him to believe that when the disease is slowly ushered in, it is more obstinate and enduring than when it is suddenly developed. An irregularly remittent course he regards as an inherent quality of the disease, (*Lancet*, l. c.)

Treatment.—The indications of cure are, (1.) To remove, if possible, all morbid states of the body which may tend to aggravate the disease, such as *constipation, anæmia, amenorrhœa, worms;* (2.) By well-regulated purgative medicines, to subdue any cerebral congestion; (3.) To sustain the strength and improve the vigour of the nervous system by tonic and stimulant medicines, by food, and by the cold bath.

The particular tonic is not of much moment. Dr. Wood recommends the powder of the black snake root (*cimicifuga*), in doses of from half a drachm to a drachm, or from one to two fluid ounces of a decoction; or from one to two drachms of a saturated tincture should be given three or four times a day, and continued for several weeks, the dose being gradually increased till it produces headache, vertigo, or disordered vision. The sulphate of zinc has also had the credit ascribed to it of curing a large number of cases, beginning with a grain in the form of a pill, three times a day, and increasing the dose till it reaches seven or eight grains daily. The preparations of iron are also frequently resorted to with benefit.

Dr. Walshe did not find any of these remedies at all useful in the acute case he has described. Of all the remedies he tried, the "extract of *cannabis Indica* was followed by the most satisfactory results. It exercised a sedative influence on the muscular action in a marked degree, and that immediately. *Nitrate of silver* he also found to have no mean influence in aiding the cure. The *Indian hemp* was given in doses of one-fourth of a grain of *the extract* thrice daily. The dose was subsequently increased to half a grain, and at the same time one grain doses of *nitrate of silver* were administered, and a draught containing eight drops

of *dilute nitric acid*, (*Lancet*, l. c.) Dr. Corrigan had also previously used *Indian hemp* with much success in chorea (*Med. Times and Gazette*, 1845, p. 29; also *Dublin Hosp. Gazette*). The student is recommended to consult a valuable paper "On the Uses of Indian Hemp in Nervous Diseases," by Professor Russell Reynolds, in Beale's *Archives*.

Of other classes of stimuli, *camphor* in five grain doses has acquired much reputation, especially after the discharges have become healthy by the action of purgatives. Many young women, also, who attribute the attack to fright, frequently get well from the simple administration of the *spirit of nitrous ether* in one fluid drachm doses three times a day, combined with the officinal *camphor mixture*. The catalogue of remedies proposed is endless. In many instances, however, the above medicines are continued for weeks without any manifest improvement. In such cases the cold bath, or the cold shower bath, is an excellent adjuvant; and, unless the patient is suffering from some structural disease, the case uniformly yields to this conjoined treatment; great care and attention being bestowed on regulation of the diet, which should be light, nutritious, and easily digested.

Ref. 8.1-70

HYSTERIA.

LATIN, *Hysteria;* FRENCH, *Hystérie;* GERMAN, *Hysterie;* ITALIAN, *Isterismo.*

Definition.—*A complex morbid condition of all the cerebral functions, of a chronic kind, probably associated with some morbid state of the emotional or sensori-motor centres, and presenting every variety of alteration, so that the phenomena of hysteria simulate or mimic the phenomena of almost every other disease, while the most common and characteristic features of the affection are certain motorial changes of a convulsive nature, and usually of paroxysmal occurrence.*

Pathology.—Three theories have been entertained relative to the nature of this disease, and to the primary seat of the affection: (1.) Some, with the ancients, refer it to a morbid condition of the uterus. (2.) Others consider it exclusively due to a morbid state of the cerebral structures. (3.) A third class refers the phenomena to a morbid excitability of the whole nervous system, which renders it liable to be thrown into disorder by causes

insufficient materially to disturb its action in health—thereby implying paralysis of some nervous centres. *Post-mortem* examinations of the bodies of those who have died from other diseases while suffering from hysteria have yielded negative results.

Symptoms.—The forms and degrees of hysteria are so numerous that the difficulty of describing this disorder is very great. The modifications of age, temperament, states of nervous sensibility, physical and moral education, and grades of society, so influence its aspect that it is only possible to give a mere general outline. It is usually divided into three forms: *first*, that which is characterized by what is termed the "*globus hystericus*" in which the sensation of a ball rising in the throat, or a feeling of suffocation, is experienced by the patient, but without convulsions; *second*, its paroxysmal form, or that in which the *globus hystericus* occurs with convulsions; and *third*, those irregular and anomalous phenomena which often manifest themselves during the intervals of severe attacks.

The milder forms are those which terminate without the formation of the paroxysm. They commonly begin with pains in the epigastrium; in the left side, or in some other part of the abdomen; or the patient is unusually nervous, her feelings excited or depressed. These symptoms having existed for a longer or shorter period, the patient experiences the sensation of a ball, the "*globus hystericus*" rising apparently from the lower portion of the abdomen, and proceeding upwards with various convolutions to the stomach, thence to the throat, and causing sometimes an intense sense of suffocation. At this point the slighter forms frequently cease, but are followed by headache, stiffness of the neck, general weariness, a profuse discharge of a light-coloured limpid urine, and by great flatulence, the abdomen becoming almost instantaneously distended.

When hysteria assumes a paroxysmal form or "fit," it may be preceded by the pains and mental feelings which have been described; but not unfrequently the attack is sudden, and is often caused by some transitory occurrence. In such a case the patient bursts out into a fit of immoderate laughter or crying, the *globus hystericus* begins to form and to rise, and no sooner reaches the throat than she falls to the ground, apparently unconscious and violently convulsed. The fit is now said to be formed, and

while in general the convulsions are easily controlled, yet—not only in the strong and plethoric, but sometimes also in delicate-looking slight-made girls—many persons are sometimes necessary to restrain the patient, who writhes her body to and fro, agitates her limbs in various directions, and beats her breast repeatedly with her arm and hand. During the fit the patient also often knocks her head against the bed or floor, tears her hair, screams, shrieks, laughs, cries, or sobs alternately. The respiration is slow, and is rendered still more laborious by spasms about the pharynx and glottis, so that the patient often grasps her neck and throat, or rubs or strikes the epigastrium and side with her hand. During this struggle she may bite her own arms or those of the bystanders, and will sometimes move round the room while lying on her back, by means of the muscles of the dorsal region. The abdomen is often singularly distended with flatus; but in other cases the muscles of that region are tense and irregularly contracted. The pulse is in some cases increased by the violence of the exertion, but in others its beat is natural. The veins of the neck are distended, the carotids beating with more than usual violence. The face is flushed, and "the head is generally thrown back, so that the throat projects; the eyelids are closed, but tremulous; the nostrils distended; the jaws often firmly clenched; there is no *distortion* of the countenance, and the cheeks are at rest," unless when giving expression to some of the above-mentioned phenomena. The temperature of the extremities is often lower at the commencement than natural, so as to cause a momentary shivering; but as the paroxysm forms the heat is usually restored, and sometimes increased. The phenomena attending the subsidence of the paroxysm are very various; sometimes a flood of tears, a fit of laughter, or an exclamation, is followed by a great flow of limpid urine, after which the recovery is generally rapid and complete. In other cases the action of the stomach becomes inverted, and the sympathizing attendant, perhaps watching the patient with the tenderest care, receives its whole contents over her person, after which the patient may lapse, most unconcernedly, into a profound sleep. In others, again, the fit only partially passes off, and the patient lies, to a certain extent, sensible of what is passing about her, perhaps jaw-locked, the secretion of urine suspended, unable to talk, and often obliged to be fed. The fit having entirely subsided, the

patient lies exhausted and unwilling to be disturbed, and although more or less conscious of what has passed, she wishes to be thought ignorant of all that has taken place. A want of consciousness may exist when the fit assumes a severe or epileptic form, but this is not a common symptom of the purely hysterical convulsion. In some few cases the patient appears to be delirious, and makes the most extraordinary noises, such as barking or howling like a dog. The duration of the fit is very various, from a few minutes to two, three, or more hours. These fits readily recur, and no sooner is one fit ended than the patient suffers from another; and in this manner the whole attack may last twelve, twenty-four, or even forty-eight hours. In general the intervals are much longer, and not subject to any general law of recurrence, except that they are more common about the period of menstruation.

In the interval between fits, the symptoms are extremely anomalous and irregular, and more strange and difficult to describe than even those of the paroxysm. Some have their senses so acutely alive that although the window and bed-curtains may be drawn, still they are pained with light, and the slightest noise distresses them. In some, again, the sense of touch is so exquisite that they can scarcely bear the weight of the bed-clothes; and to others odours are similarly intolerable. Besides this extreme acuteness of the senses, others suffer pains under or in the mammæ, known to surgeons as the "hysterical breast," lumbar pains, pains in the hip-joint, headache fixed to one spot, *clavus hystericus*, and palpitation. Pain in the region of the spine is also frequent, and often so intense and so exquisitely increased by pressure that it has often been mistaken for ulceration of the intervertebral cartilages. The late Sir B. Brodie recorded that he had seen numerous instances of young ladies condemned to the horizontal posture, and to the torture of issues and setons for successive years, whom air, exercise, and cheerful occupation would have cured in a few weeks. As to painful affections of the joints, it has been stated by the same high authority, that at least four-fifths of the females among the higher classes who are supposed to labour under diseases of the joints are suffering from hysteria, and from nothing else. The morbid sensibility is chiefly in the integuments, as in the case of the hip-joint, and if they are slightly pinched or drawn from the subjacent parts, the patient complains more than when the head of the femur is pressed

against the acetabulum. There is likewise no wasting of the *glutei* muscles, nor flattening of the *nates*, nor painful starting of the limbs. In some instances the patient becomes paraplegic, and is unable to walk, while others suffer temporarily from *hemiplegia*.

It is the extreme acuteness and exquisite sensibility of the senses in hysteria which has led those less skilled in female arts to believe in the instances of animal magnetism and mesmerism they seemed to exhibit, which formerly attracted so much public attention. A most interesting account of the vagaries of hysteria may be read in Dr. Watson's Thirty-eighth Lecture, *On the Practice of Physic*.

Diagnosis.—The best diagnostic guide may be obtained by classifying the symptoms according to Dr. Reynold's plan, as followed in the description of the previous diseases. There is to be noticed—

1. *The Mental State.*—Volition is deficient and misdirected. The Emotions and Ideas exhibit excessive activity; and to the combination of these two conditions is to be attributed many of the peculiar and characteristic features of the disease. *Assertions* by the patient are being constantly made—such as that she cannot control her Thoughts, Emotions, Expressions, or general voluntary movements; or that she cannot move this or that limb, that she cannot open her eyes, that she cannot stand or walk; and if she makes the attempt under such impressions, she certainly fails; and she may simulate the real inability so completely, and so well, that it seems almost incredible that nothing but defective Will is the real source of the failure. If, however, some strong Motive, Emotion, or Sensation, come into operation, she may for a moment forget her condition, clap the hitherto moveless hands together, open the closed eyelids, and, with the rapidity and energy of robust health, run across a room or up a staircase with her *quasi*-palsied limbs. It does not appear that with all this there is any intention on the part of the patient to deceive any one, more than herself. It is truly a morbid mental condition on her part, and she doubtless believes in the real nature of her symptoms. Often, also, a species of delirium prevails, in which nonsensical sentences are pronounced in an excited manner. Uncontrolled sobbing, sighing, and laughing are alternately produced, or accompany each other. Somnambulism, ecstasy, or

hysteric coma (which is rare), may prevail. Often the expression of the face is insane. A listless, abstracted, vacant look pervades the countenance, as if the individual cared nothing for the things of this world. Combined with this condition there is restlessness and impatience of temper, with monosyllabic talking.

2. *Sensorial.*—The pain of hysteria, which may be anywhere, but most commonly in the head and mammary region, is always described as "intense," "horrible," or "agonizing," and is increased when the attention is directed towards it, but lessens when the attention is withdrawn. The patient generally shrieks when the skin is touched.

3. *Motorial* phenomena, when voluntary, are performed sluggishly and imperfectly. The other phenomena in connection with the motor power are exhibited in convulsions or paralysis. It is the convulsive paroxysms of hysteria which may be mistaken for epilepsy. When they occur, it is almost always at the period of puberty in young females. They frequently attend the menstrual period, and are preceded by the premonitory phenomena of hysteria already described, and which re-appear towards the close of the convulsions. There is probably never complete loss of Sensibility and Perception. The spasmodic movements are general. The face undergoes little alteration. There is commonly a contractile movement of the eyelids. The patient appears to see, and there is no marked change of the pupil. Foaming at the mouth or a bitten tongue is rare. The attacks are sometimes of considerable duration, and the respiratory movements become very disorderly. After the paroxysm has passed, there is no marked stupor, but merely general exhaustion; and loss of Consciousness appears to be very seldom complete, and never occurs at the outset of the attack. "The patient," writes Dr. Watson, "is often able to repeat (although she may not always choose to confess it) what has been said by the bystanders during the period when she seems insensible. This is a point of distinction well worth remembering, for more reasons than one. It not only helps the diagnosis, when the fact comes out, but it suggests certain cautions to ourselves. We must take care not to say anything by the bedside of a hysterical patient which we do not wish her to hear; and we may take advantage of her apparent unconsciousness, and pretend to believe in it, and speak of certain modes of treatment which she will not much approve

of, but the very mention of which may serve to bring her out of the fit."

The less expressed forms of hysteria cannot be confounded with the less expressed forms of epilepsy. The non-convulsive form of epilepsy is exclusively expressed through disordered sensorial states, such as by vertigo and a suspension (however brief and transitory) of the mental powers. The non-convulsive forms of hysteria, on the other hand, are chiefly expressed in derangement of the organic functions of the thorax and abdomen (FOVILLE, WATSON).

It is often difficult to distinguish between the many painful affections of the joints which arise from hysteria and the formidable diseases of these parts which they simulate, mimic, or copy; and many mistakes have been made fatal to health and even to life. The character, however, of the patient, her time of life, her general good health, the intermitting nature of the pain, and its following the course of the nerve, enable us generally to determine with much accuracy between these different classes of disease. The most common mistake, however, is that of considering the pains under the mammæ as pleurisy or disease of the liver, or the abdominal pain as peritonitis or enteritis, thereby leading to an abuse of bleeding, blistering, and the administration of mercury. The state of the pulse, however, the general good health of the patient ("for," writes Dr. Wood, "one of the most striking circumstances connected with the disease is the general integrity of the nutritive process—the patient continues plump and rosy"), and most commonly the existence of some uterine irritation, furnish sufficient grounds for diagnosis between these different diseases.

Nausea, eructations, borborygmi or tympanitis, palpitation of the heart with syncopal feelings, frequent micturition of clear pale urine, are characteristics of the hysterical state. A certain constitution is also characteristic of the sufferer from hysteria. The external conformation of the features of the face is often of itself sufficient to indicate the existing tendency. The "*facies hysterica*" may be recognized by the remarkable depth and prominent fulness of the upper lip, which is more or less thick. There is also a fulness of the eye, with a tendency to drooping of the upper eyelids.

Causes.—The remote causes of this affection are rather moral

than physical; and in a young person predisposed to the disease almost any mental emotion will excite it, as anger, disappointment, jealousy, protracted expectation, the loss of a husband, a friend, or a child; indeed, all that brings the Passions, Emotions, or Affections of the mind into play is a cause of this disease; and many women cannot go to church, or witness a tragic representation, without suffering from hysterical paroxysms.

This disease almost exclusively attacks females between the ages of fifteen and thirty, or during that period of a woman's life when the generative functions are fully developed and in their greatest vigour. Those most liable are the unmarried or continent, and those that labour under amenorrhœa or menorrhagia. The married woman often suffers just after conception, or before parturition, or subsequently as a consequence of protracted suckling. The barren woman, however, is more liable, and probably from her mind being acted upon by a greater number of exciting causes, such as disappointment in the prospect of being a mother. Taking classes of women, the higher classes, from their artificial modes of life, are greater sufferers than the lower orders. But although this is a disease almost peculiar to woman, it is not entirely so, but occasionally affects the male sex under conditions of mingled debility and excitement. Shakespeare makes Lear exclaim, when Gloster relates the cause of his being put in the stocks—

> "Oh, how this mother swells up toward my heart!
> *Hysterica passio!*—down, thou climbing sorrow,
> Thy element 's below!"

The predisposition to the disease, however, is most manifest in that peculiar condition of the nervous system for which we have no more precise or definite expression than *nervous irritability* or *mobility*—a condition which is more common in women and children than in men, and more common in all persons when in a state of weakness than when in the full enjoyment of muscular strength. In women the affection is more common about the menstrual periods, and immediately after parturition, than at other times; more common likewise among those in whom the monthly discharge is habitually *excessive*, or *altered* (as in *leucorrhœa*), or suddenly *suppressed*, or more gradually obstructed (as in the different forms of *amenorrhœa*). In this condition of mobility both Sensations and Emotions are intensely felt, and

their agency on the body is stronger and more lasting than usual; continued voluntary efforts of Mind, and steady or sustained exertions of the voluntary muscles, are difficult or impossible; the muscular motions are usually also rapid and irregular.

Prognosis.—The ultimate result of these cases, though often long and tedious, is always favourable. "In nine hundred and ninety-nine cases out of a thousand, hysteria is attended with no ultimate peril either to mind or body" (WATSON).

Treatment.—The treatment may be divided into what should be done during the fit, and into what should be done afterwards.

When the patient falls in a fit of hysteria, the first thing to be done is to loosen everything tight about her person. The window should be opened, and the cold air allowed to blow over her. She should then be laid in the horizontal posture on a bed, or on the floor, as a means of rendering the circulation through the brain more equal, and to enable us the more readily to control the convulsive movements of her body. This being done, many modes of further proceeding may be followed. Some recommend, in plethoric cases, that the patient should be bled—a remedy certainly in many instances manifestly improper, and in all of doubtful efficacy. When the jaw is locked, Dr. Wood recommends that an enema, consisting of the yolk of an egg beat up with two drachms of asafœtida, with half a pint of water added, may be administered; or, still better, an enema of turpentine, in which half an ounce of turpentine is similarly mixed with the yolk of an egg, and half a pint of water added. These remedies, in some instances, he adds, instantly remove the affection, but in other cases not for some hours. Another remedy is to fill the mouth with salt: "You generally see them come round if you fill the mouth with salt." The remedy, however, which supersedes all others, and is unquestionably the best, is a good drenching with cold water. "I believe there is more virtue in cold water than in any other single remedy" (WATSON). If the patient lie on the bed, the head should be drawn over its side, and a large quantity of water poured on it from a considerable height out of a pail, jug, or other large vessel, and directly over the mouth and nose of the patient, so as to stop her breathing and compel her to open her mouth. This practice is generally introduced into hospitals, and until it was adopted it was not unusual to see three or four patients in hysteria in the same ward, and at the same time. Under this

practice, however, an hysterical case is rare, and the fit seldom occurs twice in the same person, and never becomes epidemic.

After the paroxysm is over, if the patient complains of continued headache, a few leeches to the temples may be necessary, especially if the urine be small in quantity and high-coloured; but in all other cases leeches, blistering, or cupping should be avoided, as tending rather to aggravate than to control the disease. The next object is to regulate the bowels by such remedies as may be necessary, and at the same time to support and tranquillize the patient by stimulants, such as *ether* or *asafœtida*, combined with *hyoscyamus* in the form of tincture, the *syrup of poppies*, or small doses of *morphia*. The state of the uterine functions is next to be inquired into. If leucorrhœa be present, or the menstruation be profuse, the *mineral acids*, or the *bitartrate of potass*, will be found most efficacious, by restoring a more healthy state of the deranged organs.

The urine is often suppressed for a time after an attack of hysteria; but unless the bladder be sensibly, and perhaps painfully distended, no attempt should be made to draw the urine off. Something more should be hazarded to avoid this necessity, for the catheter once passed, that operation will require to be performed morning and night, perhaps for several months.

CATALEPSY.

LATIN, *Catalepsis;* FRENCH, *Catalepsie;* GERMAN, *Catalepsie;* ITALIAN, *Catalepsia.*

Definition.—*A sudden suppression of Consciousness; but instead of falling down convulsed, as in hysteria, the patients maintain the position in which they were when the attack commenced. The limbs and trunk persist in a state of balanced muscular contractions; the same expression of countenance which may chance to be at the moment of seizure is preserved. If sitting, the patient continues to sit; if standing, he continues to stand; and if occupied in any mechanical employment, he continues fixed in one attitude; and if he is under the influence of any Passion, the countenance retains its expression.*

Pathology.—This is an extremely rare form of nervous disease, apparently intermediate between hysteria and epilepsy; but probably more allied to hysteria. It affects the two sexes nearly

with equal frequency. Dr. Reynolds has observed the cataleptic state ensue in cases of chronic ramollissement of the brain, and in tubercular meningitis; and Dr. Laycock compares the condition to the state presented by the so-called "*brown study.*" The combination of fixed attitude and of unvarying expression gives to the patient the air of a statue rather than that of a living being, and he appears as if suddenly changed to stone. The most remarkable circumstance, however, in this disease is, that the attitude of the body and position of the limbs admit of being changed almost into as many new forms as a painter's lay figure, and the new position, however inconvenient, and almost volitionally impossible, is preserved till again changed, or until the paroxysm has subsided.

Besides this singular state, Consciousness is suspended, and the patient neither receives any impression from external objects, nor retains any recollection of what has happened during the fit.

In this respect the disease approaches in character to epilepsy. The organic functions of life, however, continue to be performed, though feebly. The pulse and respiration are regular, only the former is smaller and the latter less frequent than in health. The colour of the countenance is either pale or undergoes no change. The fit may last a few minutes or a few hours, and is said to have continued in some cases three or four days. The patient at length awakes as from sleep, and generally with a deep sigh, when all the functions of the body are suddenly restored. The attack is generally sudden, and without any previous symptoms, but it is sometimes preceded by headache, stiffness of the neck, or some obvious torpor of the mind or body. The return of the paroxysm is very uncertain, but the disease seldom subsides with the first attack. The following case, given by Dr. Gooch, will best exemplify this affection:—

A lady who laboured habitually under melancholy, a few days after parturition was seized with catalepsy, and presented the following appearances:—She was lying in bed motionless, and apparently senseless. It was thought the pupils of her eyes were dilated, and some apprehensions were entertained of effusion on the brain; but on examining them closely it was found they readily contracted when the light fell upon them. Her eyes were open, but there was no rising of the chest, no movement of the nostril, no appearance of respiration. The only signs of

life were warmth and a pulse which was 120, and weak. Her fæces and urine had been voided in bed. In attempting to rouse her from this senseless state the trunk of the body was lifted up and placed so far back as to form an obtuse angle with the lower extremities, and in this posture, with nothing to support her, she continued sitting for many minutes. One arm was now raised, and then the other, and in the posture they were placed they remained. It was a curious sight to see her sitting up staring lifelessly, her arms outstretched, yet without any visible signs of animation. She was very thin and pallid, and looked like a corpse that had been propped up and stiffened in that attitude. She was now taken out of bed and placed upright, and attempts were made to rouse her by calling loudly in her ears, but in vain; she stood up, indeed, but as inanimate as a statue. The slightest push put her off her balance, and she made no exertion to regain it, and would have fallen had she not been caught. She went into this state three times; the first lasted fourteen hours, the second twelve hours, and the third nine hours, with waking intervals of three days after the first fit, and of one day after the second; after this time the disease assumed the ordinary form of *melancholia*. It might be supposed that symptoms such as these were feigned; but there are cases beyond suspicion of this kind; and another very interesting case is related by Dr. George Buchanan in *The Glasgow Medical Journal* for July, 1857. It is an instance of this singular affection occurring in the male sex.

Prognosis.—The affection is generally innocent; but as it is apt to be associated with cerebral disease, which may end in cerebritis, apoplexy, or insanity, and also with serious organic disease of the viscera (REYNOLDS, WOOD), it behoves the physician to be guarded in predicting results, especially in our ignorance of the nature of this disease.

No constant line of treatment can be stated. The individual case must be judged of upon its own merits, and prescribed for according to the principles which have guided the dictates of treatment in the allied nervous affections.

EPILEPSY.

LATIN, *Epilepsia;* FRENCH, *Epilepsie;* GERMAN, *Epilepsie*—Syn., *Fallende Krankheit;* ITALIAN, *Epilessia.*

Definition.—*A complex nervous state, in which, as a rule, a sudden and complete loss of Consciousness prevails, associated with convulsions, as if tonic at first, but which subsequently become clonic, and ultimately impede the respiratory process. The attack, lasting from two to twenty minutes, is followed by some exhaustion and sleep. The expression of the epileptic state varies from the most severe paroxysm to simple vertigo, a momentary suspension of Consciousness, a fixity of gaze, a totter of step, and a confusion which appears and disappears almost instantaneously, and which only the patient can recognize.*

Pathology.—This disease has been known from the earliest antiquity, and is remarkable as being that malady which, even beyond insanity, was made the foundation of the doctrine of possession by evil spirits, alike in the Jewish, Grecian, and Roman philosophy. The interest and importance which attaches to this disease cannot be better expressed than has been done by Dr. Watson. He writes that it "is scarcely less terrible to witness, when it occurs in its severer forms, than tetanus or hydrophobia; but it is not attended with the same urgent and immediate peril to life. Yet it is, upon the whole, productive of even more distress and misery, and is liable to terminate in even worse than death;—a disease not painful probably in itself; seldom immediately fatal; often recovered from altogether; yet apt in many cases to end in fatuity or insanity; and carrying perpetual anxiety and dismay into those families which it has once visited," (Watson, Lect. xxxv.) Again, fully impressed with the responsibility entailed on the physician in the diagnosis between hysteria and epilepsy, and the necessity of its being certain and accurate in either case, he says, "It is a dreadful announcement to have to make to a father or a mother that their child is epileptic," (Lect. xxxviii.)

It has been affirmed that in fifteen out of twenty cases, in which the brains of epileptic patients have been examined, the structure of that organ has been in every respect healthy. Even when the patient has died during the paroxysm, the brain has in many instances been found congested only. Epilepsy has been therefore regarded as a functional disease, the particular seat of

lesion not being determined. But although epilepsy may exist without any obvious disease of the brain or of its membranes, it must be admitted that the brain and its membranes are occasionally found in every state of disease to which those parts are liable. Thus, the membranes may be inflamed, thickened, or ossified, and with every variety of exudation; or the substance of the brain may be indurated or softened—the seat of abscess, of cancer, of tubercle, or of other structural disease. Any such structural disease is then considered to give rise to the epileptiform attack. Dr. Sieveking, whose researches into the nature of this disease have been most prolonged and laborious, once showed me an interesting old German work, by T. and C. Wenzel, in which the epileptic state was shown to have been invariably found associated with a morbid state of the *pituitary* body in the *cella turcica*—a spot of the encephalic region very rarely examined in *post-mortem* examinations. The tendency of modern pathology seems to be to connect the epileptic seizure with a variety of pathologico-anatomical lesions of a variable and inconstant kind, such as have been mentioned. There are also cases referred to causes of an eccentric nature, such as to uterine or ovarian disease, which are thus said to act upon the brain through the medium of the nervous system, in some way as yet unknown. Dr. Todd developed a theory of the disease, suggested by the occasional occurrence of epilepsy with renal affections. He held that the peculiar features of an epileptic seizure are due to the gradual accumulation of a morbid material in the blood, until it reaches such an amount as to operate upon the brain, as it were, in an explosive manner. In other words, the influence of this morbid matter, when in sufficient quantity, excites a highly polarized state of the brain, or of certain parts of it, and these discharge their nervous power upon certain other parts of the cerebro-spinal centre, in such a way as to give rise to the phenomena of the fit. This theory assumes that the essential derangement of health in epilepsy consists in the generation of a morbid matter which infects the blood, and it supposes that this morbid matter has a special affinity for the brain, or for certain parts of it, just as *strychnine* exercises a special affinity for the spinal cord. According to this theory the disease ought to have found a nosological place amongst the *constitutional diseases*. But, to give a definite character to such a humoral theory, it

were necessary to discover some morbid matter in the blood in every case of epilepsy.

"This desideratum has, as yet, been only partially obtained. The clue to a discovery of this kind was first given by the observations of Prevost and Dumas upon the effect of excision of the kidneys. These observers found that the removal of the kidneys always led to an accumulation of a considerable quantity of urea in the blood, followed by convulsions and coma—an epileptic state. After this, clinical observations by practical physicians showed that disease of the kidney was apt to be followed by attacks of convulsions and coma, when the excretion of urine fell in quantity to a very low amount; and it was found that, in such cases, a considerable quantity of urea was present in the blood. A connection was clearly thus established between the presence of urea in the blood, defective renal action, and the epileptic condition; but whether the active poison is urea cannot yet be decided. Frerichs, indeed, has lately affirmed that it is carbonate of ammonia, a product of the decomposition of urea. But even this is still *sub judice.* All that we really know is, that in certain states of diseased kidney, when the excretion falls below a certain point, urea will accumulate in the blood, and epileptic seizures will ensue; and, should the patient die, we find no brain-lesion to explain the phenomena; but we find unequivocal evidence of diseased kidney" ("Clinical Lectures," by Dr. R. B. Todd, *Med. Times and Gazette,* Aug. 5, 1854).

In the present state of our knowledge, therefore, and knowing that there are a great many cases in which the epileptic phenomena have recurred during a long period, and in which *post-mortem* examination reveals no lesion with which symptoms can be connected, it is then better to consider epilepsy as an intrinsic disease of the brain, because the most constant and marked groups of phenomena are referable to the functions of the central parts; while the loss of Consciousness, associated with excessive mobility, leads one to regard those parts of the brain in the immediate vicinity of the *cella turcica* and basilar portion of the occipital region—for example, the *central ganglia* or *medulla oblongata*—as parts where, in future, morbid anatomy may yet discover a lesion. On the other hand, epilepsy in very many cases must be regarded as "a disease of the whole man, and not of any one organ or system of organs alone;" and if lesions of a more or less constant kind be ever found in the brain, they would merely stand in the same relation to epilepsy that morbid states

of the kidney may be regarded in relation to the whole phenomena of Bright's disease, regarded as a *constitutional disease.* Epilepsy, therefore, might with fair reason be regarded in this respect as a *constitutional disease,* with intervals of apparent freedom, and with times at which the disease culminates in the characteristic paroxysm; and in order fully to appreciate the nature of epilepsy, as Dr. Sieveking justly remarks, a careful study of the general condition of each patient is necessary, and especially of the phenomena which may show themselves in the free intervals. Attention must not be limited to the paroxysm alone.

Symptoms.—Epilepsy may be grave or slight. The attack often occurs without any previous warning; so much so that Georget estimates that in 95 cases out of 100 there are no premonitory symptoms. These warnings are known by the term "*aura.*" They comprise all the premonitory symptoms which may prognosticate the approach of a fit. Dr. Sieveking has noted such "warnings" in 48 out of 104 cases—a little more than 46 *per cent.* Many patients, however, on the approach of the fit, have vertigo or headache; some swelling of the veins, or throbbing of the arteries of the head; while others, again, have ocular spectra, or affections of the other senses. Dr. Gregory used to mention, in his lectures, the case of an officer whose paroxysm was always preceded by the spectre of a little old woman dressed in a blue cloak, who issued, as he imagined, from the corner of the room, and knocked him down with her stick. Dr. Fothergill attended a Quaker who always fancied he saw his garb covered with spangles before he fell into the fit. These ocular spectra are very numerous; but the most common are flashes of light, tadpoles, flies, coloured areolæ around the flame of the candle, black dogs, and white horses. Others have hallucinations of hearing, as the ringing of bells, or the roaring of the sea; while others, again, are annoyed by the smell of disagreeable odours, or by the sensation of unpleasant tastes. When the sense of touch is the seat of the hallucination the term "*aura epileptica*" is used to express it. In these cases the patient has often the sensation of a fluid creeping from the fingers or toes upwards towards the trunk; others feel as though a spider or other insect were crawling over the skin. Dr. Elliotson speaks of a patient that had two *aurœ,* each of which ran along the dorsum of each foot, ascended up the front of the legs and thighs to the trunk, where they broke into

five streams, all of which again met at the epigastrium, and, having reached this point, he fell into the fit. The late Dr. John Thomson, of Edinburgh, relates an instance of an epileptic "*aura*" commencing in an old cicatrix in the side; and Dr. Watson mentions the warning sensation as originating in the thumb of one of his patients, which presently became twisted inwards; and he could sometimes prevent the complete expression of the fit by tying his handkerchief tightly round the throat. Esquirol relates the case of a woman, in which the *prodrome* consisted in the patient turning round for a considerable time; and another of a man, who ran with all his might, till at length he fell down, overpowered by the disease.

Although these sensations may be subjective, and experienced only in the skin, and not following the course of any particular nerve, yet their subjective origin may "be due to some injury done to, or some morbid impression made upon an *afferent* nerve," as well as to some morbid condition of the brain itself.

Regarding the frequency of the occurrence of individual symptoms, Dr. Sieveking met with headache in 56 out of 104 cases, or in a ratio of 53·8 *per cent.;* and the pathological import of the symptom varies much according to the period at which it is met with. It may be connected with the fit etiologically; or it may be a consequence of the attack; or it may be a casual coincidence (*On Epilepsy and Epileptiform Seizures*, second edition, p. 54).

In the *adult,* whether the warning symptoms be or be not present, the attack usually commences by the patient uttering a cry, losing on the instant all Consciousness, and falling down in convulsions, his mouth covered with foam. The convulsions vary from the most trifling and transitory convulsive movement to the most frightful, terrific, and long-continued struggles. In mild cases only one limb is convulsed; in others only the face, the lip, or the eye. Esquirol gives the case of a lady whose fits were so slight that although often seized on horseback she never fell off. In a few seconds she recovered, and resumed the conversation by finishing the sentence she was expressing. In this case, however, the epileptic cry and the convulsed eye denoted the true nature of the attack. Another lady, advanced in life, suffered from fits so slight that she preserved her seat in the chair; and except for the occurrence of some slight convulsive motions about the mouth, followed by a short sleep, the attack would have passed unnoticed.

Attacks so mild often occur many times in the day, last about five minutes, and appear for a time to leave no feeling of ill-health behind.

In severe forms of epilepsy the convulsions are more formidable; the hair stands on end, the forehead is wrinkled, and the brow is knit. If the eyelid be opened, the eye is seen to be injected, sometimes convulsively agitated, at other times in a state of strabismus, and sometimes fixed; more commonly the eyelid is quivering, and half open, so as to show the white of the lower portion of the conjunctivæ. The face is red, or livid and swollen, the teeth generally clenched, and the lips covered with foam; sometimes, however, the mouth is open and the tongue thrust forward; and should the masseter muscles now act spasmodically, it may be bitten through, or otherwise much injured, and the foam consequently be mixed with blood. The force with which the jaw closes is so great that teeth have been known to be broken and the jaw luxated. The limbs, also, are violently convulsed, thrown about in every direction, and with such power that it often requires three or four persons to prevent the patient seriously hurting himself. In these convulsions, also, the hands are strongly clenched, and the body is often arched backwards (*opisthotonos*); when, on the muscles relaxing, the patient may fall to the ground with great force. While the limbs and trunk are thus powerfully agitated, the muscles of the chest are often spasmodically fixed, so as hardly to permit the acts of respiration.

The functions of organic life are also implicated in this scene of tumult. The pulse is generally frequent, sometimes hard and intermittent, and at other times scarcely perceptible, although the heart's beats are strong and tumultuous. The respiration is stertorous, the stomach and bowels troubled with borborygmi, the skin bathed in sweat, while the urine, semen, or fæces are occasionally emitted. Blood sometimes flows from the eyes, ears, or nose, frightfully expressive of the violence of the attack.

When the paroxysm has reached its crisis the muscles relax, the convulsions subside, the respiration becomes more free, the pulse more regular, and the countenance more natural; and at length the patient falls into a heavy sleep, from which he awakes sometimes in good health, but more often shaken, exhausted, and suffering from severe headache, which lasts some hours or even

days. In neither case, however, has he the slightest consciousness or remembrance of what has passed. In other instances the termination of one paroxysm is but the beginning of another, and the succession is occasionally so continued that the attack, with short intermissions, may last twenty-four or forty-eight hours, or even longer.

When *children*, from teething or other causes, are seized with epilepsy, the attack is often preceded by a spasmodic affection of the larynx, causing the whooping or crowing sound so well known to every practitioner; but it may, and often does, take place without any warning. In the former case the child perhaps is in his best health, but on awakening is seized with the characteristic whoop, often accompanied by a spasmodic flexion of the thumb against the palm; or the fingers are clenched, or the toes bent. These symptoms may recur a varied number of times, till at length, with or without this warning, the eye is seen staring, fixed, or convulsed; the face and extremities pale or livid; the hand clenched, the body rigid, and the head and trunk curved backwards. The fit is now formed; and if we examine the *fontanelle* we find it distended and pulsating. These symptoms generally last only a few minutes, when a strong expiration takes place: a fit of crying succeeds, and the child, much exhausted, recovers its Consciousness, and after a short interval generally falls asleep. These convulsions seldom occur during the early periods of lactation, nor until the commencement of the period of dentition, and rarely after three years of age.

The duration of the paroxysm in children seldom lasts more than a few minutes. In the adult it often does not exceed that period; but in many cases it lasts half an hour to two hours; while in others the greater part of the day passes before the paroxysm terminates.

It seldom happens that the paroxysm occurs but once. In the mildest case in the child it is commonly repeated three or four times in the course of the first three or four years of childhood, while in other cases it will occur three or four times in the day; and in severe cases the child is hardly out of one fit before it falls into another, till at length they gradually subside. In the adult the frequency of the fit varies extremely in different patients. In some instances there is an interval of several years; at others it returns annually, or every six months, or mensually, weekly, or

even daily; while others will have twenty or thirty fits in the course of the same day. The period of the day at which the attack takes place is also very varied, for it may occur during the day, at night when asleep, or in the morning when just awakening.

Causes.—When epilepsy is the result of a powerful original tendency, it often occurs without any apparent cause, and when the patient is in his best health. The effects of moral causes in its production are so well known that Raphael has introduced into his picture of the Transfiguration a boy falling into an epileptic fit. Fright is considered a very common cause. Dr. Webster says that one of the worst cases he had ever seen was that of a young female who was frightened by seeing a young man dressed in a white sheet, personifying a "ghost." Besides moral causes, errors in diet, excess of any kind, blows on the head, every structural or functional disease of the brain, and especially insanity; or any severe disease, as fever, or small-pox, are all powerful remote causes. Amongst soldiers in the guards, in the experience of Dr. Graham Balfour, the fits, with one exception, seemed to be brought on by gorging the stomach, usually with beer. He became so satisfied of this that, when turned out in the middle of the night to a man in a "fit," the excitation of vomiting generally relieved the paroxysm. In children the irritation of teething is the most common cause; and, indeed, in France epilepsy is often termed "*mal des enfans.*" Puberty is the next most frequent period at which it occurs; and its frequency as a primary disease decreases from that time till fifty, when it again increases, from the tendency the brain now has to insanity and to structural disease. As epilepsy is common in idiots whose heads are deformed, it has been affirmed that mankind become more liable to this disease in proportion as the facial angle approaches to 70°. There are many exceptions, however, to this statement. In infancy, and under seven years, epilepsy occurs in nearly equal proportions in both sexes. After puberty, when the distinction of sex is marked, some authors contend that it is more common in males than in females; Dr. Elliotson thinks in the proportion of 27 to 11; Esquirol, however, states that, on comparing the number of epileptics at Bicêtre and at Salpêtrière, the number of women attacked was one-third greater than that of the men. In an analysis of the returns of the Registrar-

General, given by Dr. Sieveking, with reference to the mortality from the disease in either sex during the past seven years, it appears that 6,729 were males, and 6,149 females, giving a relative proportion of 52·26 males to 47·73 females. Dr. Watson also states that he has seen "more epileptic boys and men than girls and women." Dr. Webster is of opinion that the disease is on the increase in this country.

Dr. Sieveking could trace hereditary tendency in 13·4 *per cent.* of his cases. Dr. Webster believes, from a combination of his own investigations with those of Esquirol and others, that *one-third* of the cases may be traced to hereditary descent. There is no doubt that a tendency to the disease is frequently hereditary. It may pass from parent to child; or it may skip over a generation or two, and appear in the grandchild or great-grandchild. The scrofulous diathesis is also a strong predisposing cause of epilepsy.

Of other exciting causes "there are certain vices," writes Dr. Watson, "which are justly considered as influential in aggravating, and even in creating, a disposition to epilepsy. Debauchery of all kinds, the habitual indulgence in intoxicating liquors; and, above all, the most powerful predisposing cause of any, not congenital, is *masturbation*—a vice which it is painful and difficult even to allude to in this manner, and still more difficult to make the subject of inquiry with a patient. But there is much reason to be certain that *many* cases of epilepsy owe their origin to this wretched and degrading habit; and more than one or two patients have voluntarily confessed to me their conviction that they had thus brought upon themselves the epileptic paroxysms for which they sought my advice," (Lect. xxxvi.)

Sir Charles Locock attributes the great increase of the disease during late years to the cause last mentioned in the above quotation (Med.-Chir. Society's "Report," *Medical Times and Gazette*, May 23, 1857). Irregularity and perverted state of the menstrual function, associated with hysteria, is another frequent source of the malady. The repression of eruptions, and especially those about the head, are also to be set down as causes which bring about the development of the disease: so are some of the *constitutional diseases*, such as *rheumatism*.

Diagnosis.—An immeasurable responsibility is associated with the diagnosis of such a disease; and, as already seen, the very

slightest cue may be all which may be given to distinguish the epileptic state. It is especially to be distinguished from *apoplexy* and *hysteria;* and the following are the classical grounds of diagnosis as given by Dr. Reynolds:—

1. *The Mental State* of the epileptic is thus far characteristic. By far the greater number exhibit a deficiency of the powers of the Will in relation especially to *Thought, Emotion, Sensation,* and *Mobility.* The mind is inclined to wander in a half-abstracted state, and without energy of purpose. There is little or no power of attention or concentration of Thought, and there is a slowness of apprehension, with defective Memory. The Emotions and their expression are undirected and uncontrolled. The patient can only give unsatisfactory and often totally unmeaning accounts of sensations experienced. Something is felt to be wrong, but the place can hardly be fixed upon; and if the head, thorax, abdomen, or limbs are referred to, the patient is rarely able to express what he has experienced. A "working in my inside" is the comprehensive phrase commonly used to express their indescribable sensations. There is also a characteristic sluggishness and clumsiness of the voluntary movements. The walk and manner of the patient become ungainly. He rolls along rather than walks, stumbling over objects in his way, in an unnecessarily awkward manner. The countenance tends to be dull, expressionless, and morose. These phenomena may be so slight as almost to escape detection; and may in many cases be overcome by a determined effort of Will. Sometimes, on the other hand, they are extremely well marked, and graduate into utter stupidity and dementia with paralysis.

2. The *Motorial* and 3. *Sensorial* phenomena are such as have been described under the head of *symptoms.*

The attacks may be distinguished into two groups, namely:—(1.) Those in which the loss of Consciousness is complete, associated with violent spasmodic movements. This group comprehends "*le haut mal*" of the French authors, and the laryngismal and tracheal epilepsy of Dr. Marshall Hall. (2.) Those in which one element predominates much over the other, even to its entire exclusion;—(*a.*) Attacks in which, loss of Consciousness being complete, there is little or no spasmodic movement. This class includes "*le petit mal,*" or "*vertigo epileptiforme,*" of the French, and the syncopal attacks of Dr. Marshall Hall; (*b.*) Attacks in

which there is marked general or partial spasms of the muscles, somewhat of a tonic kind, but in which there is no appreciable loss of Consciousness. Such seizures constitute the "abortive" attacks of Dr. Marshall Hall.

One individual afflicted with epilepsy frequently presents every variety of these attacks, while any one form may exist alone; but the essential features of a fully expressed epileptic attack cannot be mistaken. They consist of—(1.) The simultaneous occurrence of the following symptoms:—Complete loss of Consciousness, general quasi-tonic contraction of the muscles, impeded respiration, darkened face and surface generally, with distended jugulars, dilated pupil, distorted features, throbbing carotids; (2.) These phenomena are quickly followed by—persistent loss of Consciousness, clonic violent muscular contraction, laborious respiration, with tracheal gurgling noises; slight return of colour in the face and body generally; oscillation of the pupil and eyeball; chewing movements of the jaws, and foaming at the mouth; (3.) The gradual cessation of these symptoms, and the production of another stage, marked by the following characters:—Return of Consciousness for a short time, with an aspect of astonishment, alarm, and suspicion; and then followed by drowsiness or profound coma; occasional semi-voluntary movements, such as change of position, laboured slow respirations, with stertor and tracheal rattle, paleness of face, coldness of surface, with perspiration; the pupils often contracted, and the conjunctivæ injected; (4.) After sleep the patient becomes more natural in manner, and feels some headache and general soreness.

In the diagnosis of epilepsy it must be always borne in mind, especially in dealing with soldiers, seamen, prisoners, mendicants, and vagabonds, or others with whom powerful motives often prevail to feign diseases, that epilepsy is perhaps more frequently attempted to be copied than any other affection; and often with wonderful success. The means of detection consist,—(1.) In cross-examination as to the consistency or inconsistency of the accounts of the fits and general description of the attacks. This can only be well done when a perfect knowledge of the symptoms and grounds of diagnosis are familiar to the student. (2.) By observing whether or not a situation (favourable always to the malingerer) is chosen for the seizure. (3.) True epileptics seek retirement, and are frequently hurt by their falls. Feigned

epileptics delight to exhibit in public, and rarely sustain any bodily injury. (4.) Let the eyes be closely observed. In true epilepsy they are partly open, with the eyeballs rolling and distorted, the pupils dilated, and not contracting by the stimulus of light. The feigning epileptic prefers to shut his eyes completely; and may occasionally be seen to open them to "take a peep," so as to ascertain the effect of his exhibition. *His iris always acts on exposure to the light.* (5.) The skin of an impostor generally perspires from his exertions; that of a true epileptic in the paroxysm is generally cold. (6.) An impostor will not readily bite his tongue or void his excrements or urine. (7.) Tests peculiar to beadles and police constables consist in dropping melted wax upon the suspected feigning person, putting some gin into the eyes, pressing the thumb nail with force under that of the supposed impostor—an experiment productive of sudden, excruciating, and harmless pain. (8.) The mere speaking of or proposing some severe remedy in the presence of the patient is sometimes enough to detect imposition. Dr. Watson (from whose *Lectures* these statements have been condensed) specially recommends a very harmless and ingenious device—namely, in the hearing of the would-be patient, gravely to propose to pour *boiling water* on his legs as a remedy, and then to proceed actually to pour *cold water* upon them. Three humorous instances of detection are thus related by him:—

"Dr. Cheyne mentions an instance in which one table was placed upon another, and a soldier who was supposed to be shamming was laid upon the upper one while his paroxysm was on him. The fear of falling from such a height soon stopped his convulsions. Mr. Hutchinson relates the case of a sailor who was suspected to be a cheat, in whom the convulsions were instantly removed by blowing some fine Scotch snuff up his nostrils through a quill. This brought on another kind of fit—namely, a fit of *sneezing*—which lasted nearly half an hour; and there was no return of the epilepsy so long as Mr. Hutchinson remained in that ship. He tried the same expedient in cases of *real* epilepsy, but never could produce any similar effects, although the patients were not snuff-takers. There was a beggar in Paris who often fell into epileptic fits in the streets. One day some compassionate spectators, fearing that he might injure himself in his struggles, got a truss of straw and placed him upon it; but when he was in the height of the paroxysm, and performing remarkably well, they set fire to the straw, and he presently took to his heels," (Lect. xxxvi.)

Prognosis.—Epileptic convulsions during teething generally subside about the second or third year; children, likewise, first seized between three and four years old, are often cured, or the disease often subsides at puberty, except when hereditary. Epileptics attacked after puberty are generally incurable, and especially when epilepsy is conjoined with insanity. Pregnant women attacked with epilepsy are in great danger. As to the positive certainty of any cure for the disease, a proper feeling of scepticism prevails. In the majority of cases no anatomical lesions exist, even after a long series of years in which the recurrence of the fits have been more or less constant. According to the belief of Dr. Sieveking and of others, a diathesis is necessary to their occurrence, and this may be suppressed or held in check; but it is very doubtful if it can be eradicated. Nevertheless, well-selected remedies have a power in repressing the paroxysm, and often of indefinitely postponing it;—more especially dietetic and regimenal treatment. The duration of the disease before treatment is commenced has an obvious influence over its curability. "It is seldom," writes Dr. Watson, "that any permanent ill effect can be noticed as having been left behind by any one single fit; but, unhappily, this cannot be said of their repetition." "More, probably, depends," he continues, "upon the *repetition* of the fits than upon their precise *nature* or *severity*." "Every successive attack strengthens the *habit*, and renders the individual more obnoxious to future seizures; every arrest or postponement of a seizure is so much gain in favour of the patient, not only by avoiding the pain and the risk of the isolated paroxysm, but still more by diminishing his future liability to the disease" (SIEVEKING, l. c., p. 212).

Aretæus, in describing the symptoms of epilepsy, has not neglected to speak of the baneful influence of this disease on the Intellect, of the Memory being lost, of the Imagination being impaired, and of the functions of the brain being, in many patients, so subverted that they fall into incurable insanity. Esquirol gives the cases of 385 epileptics under his care, in the Hospital Salpêtrière, and he states that four-fifths were more or less insane. The remaining fifth had preserved their reason, but, he adds, "a reason so broken!"

"A single paroxysm often leaves the patient in a worse condition than that in which it found him; but this is not perceptible to an

ordinary observer until after the alteration has been rendered apparent by repeated fits and repeated small additions to the permanent injury. The friends of the patient remark that his Memory is enfeebled in proportion to the number of the attacks; that his mental power and intelligence decline. His features even assume by degrees a peculiar character; and too often he sinks into hopeless fatuity, utter imbecility, or confirmed insanity. It is this tendency which renders epilepsy so sad and fearful a disease. . . . Cases do occur in which epileptic persons preserve their faculties to a good old age; but those who are early epileptic do not often attain old age; and whenever the disease comes on, if it repeat itself frequently, it is followed much more often than not by impairment of the Mind, or by some apoplectic or paralytic affection," (WATSON, Lecture XXXV.)

Such are the phenomena associated with the paroxysms of epilepsy—a disease not only frightful from the violence of the symptoms, but also from the serious effects it may produce on the moral character, as well as on the physical frame of the unhappy patient. While some may fall into the fire, and may be burnt to death, others fall into the water, and may be drowned, although the pool may be but a few inches deep (CHEYNE). Bruises and fractured limbs are also not unfrequent. Many epileptics have a convulsive action or *tic* of the muscles of the face, or their legs waste, and are unable to support the weight of the body. In some instances the leg has been flexed under the thigh—a contraction which has lasted more than a year; while in others the patient has become paralytic.

Treatment.—The treatment divides itself into what is to be done during the paroxysm, and subsequently during the interval.

When adults are labouring under the paroxysm, little, in general, can or ought to be done except bringing the patient into fresh air, taking off what may be around the neck, and baring the chest, together with the more imperative duty of preventing the patient doing himself any injury. Bleeding, so often had recourse to, is rarely found beneficial, except, however, as regards females, in cases of suppressed menstruation. If, however, the paroxysm be greatly prolonged, the application of cold to the head, and opening the temporal artery, where symptoms of excessive cerebral congestion are obvious, may be of some service, as in cases recognized as plethoric. Keep it from biting his tongue

It is of great importance to shorten the paroxysm as much

as possible. Dr. Sieveking recommends that a trial be made of the galvanic current during the fit. The conductors should be moistened sponges, so as to insure the passage of the current to the deeper-seated tissues.

The paroxysm over, the probable exciting cause of the paroxysm should be investigated, and if possible removed; the state of the bowels should be particularly inquired into and regulated, and leeches should be applied to the temples if the headache be severe. In women, also, the catamenia, if defective or excessive, should be remedied. These few simple rules are of the first importance, not only as removing the immediate inconveniences incident to the attack, but also as a means of prolonging the interval, and perhaps preventing its future occurrence. In a few instances the patient, by their adoption, is cured, and the prevailing principles of treatment in epilepsy mainly consist in local derivation, or counter-irritation directed to subdue cerebral congestion; and in the use of such tonic remedies as may be indicated by a careful inquiry into the condition of the individual organs, and how their several functions are performed. The intensity of the headache suggests more or less active counter-irritation by *blisters, dry or wet cupping, ointment of tartrate of antimony, setons, or even the actual cautery applied under chloroform.* The most usual remedies employed are *valerian, iron, zinc, quinine, musk, opium, asafœtida, the iodide and bromide of potassium, camphor, ether, and the preparations of turpentine.* The *nitrate of silver,* once esteemed a specific in this complaint, has not only failed, but, by occasionally staining the *rete mucosum* of a dingy blue, has often permanently disfigured the patient. Of the long catalogue which has been mentioned, each medicine is perhaps useful for a few weeks; but after that period its good effects are, for the most part, lost; so that it would appear to act rather mentally than physically in removing the cause and altering the morbid tendency.

"Whatever remedies or course of treatment you pursue," writes the late Dr. Todd, "do not appear to despond, or use any other language to the patient than that of hope. Avoid extravagant promises, as inconsistent with that love of truth which ought to characterize every professional man; but unless you have the strongest evidence against it, do not yourself, nor allow your patient, to abandon hope" ("Clinical Lectures," *Medical Times,* August 12, 1854).

The employment of purgatives is indicated for the removal of waste matter to act as a derivative from the head, and expel foreign matters or worms from the intestines, and generally to regulate the bowels; and the laxatives most suited to epileptics are *rhubarb, compound colocynth pill, aloes, castor oil, taraxicum, sulphur in combination with magnesia or rhubarb;* and the Pullna bitter water imported from Bohemia, containing, as it does, *sulphates of soda, of lime, of potash, and of magnesia, carbonates of lime and of magnesia, chloride of magnesium, and phosphates of lime* with *free carbonic acid*—about 200 grains of saline matter in a pint, so that half a tumblerful taken in the morning generally produces a full pultaceous evacuation.

The judicious use of an anthelmintic sometimes frees the patient from the disease as well as from a tape-worm or other parasite, which not unfrequently may be the *eccentric* source of the fits. Independently of its anthelmintic properties, however, both Drs. Watson and Sieveking strongly recommend the use of turpentine. It may be given in half drachm doses every six hours.

The preparations of iron and zinc are the most useful tonics; and for the general principles on which iron may be administered, the reader is referred to the pages on *anæmia.*

Athough the medical treatment of the adult epileptic is so unsatisfactory, yet the treatment of epilepsy occurring in children during teething is almost always successful. The practice, on the child falling into a fit, is immediately to place it into a warm bath, and to pour cold water on its head, to lance its gums, and to administer an enema. These means generally restore the child; and the after-treatment consists in the application of a few leeches to the head, to purge the bowels with calomel, either alone or combined with some other cathartic, and to diminish the quantity of the diet. These means are all that the case will admit of, and they are very generally successful. Bleeding should be used with great moderation; for these fits in children seldom affect the Intellect, and have a tendency to subside spontaneously in a very few months. When depletion, however, is carried to excess, the child's health is greatly broken, and the probability is that the brain is rendered more irritable and the fits more frequent. Slight opiates, by soothing the irritation of the mouth, are useful in every stage of the complaint; and when greatly debilitated, some mild tonic treatment may be necessary to restore the little sufferer.

Dietetic Treatment.—In the adult the diet should be light, and the patient should live temperately. He should live by rule, for the tendency of epileptics is to gorge themselves with food or drink. He should rise early, and take regular exercise in the open air, keeping his head cool and his feet warm. The diet of an infant so affected should be, if possible, its mother's milk, with or without arrow-root. If above three or four years of age, its diet should consist entirely of farinaceous or of other light vegetable food.

ACUTE AND CHRONIC HYDROCEPHALUS.

Definition.—*An effusion of serous fluid between the membranes of the brain, or into its ventricles. The affection may be acute, congenital, or caused by disease or defective development of the brain during fœtal life, or it may occur at some period in after-life as an original disease.*

Pathology.—Hydrocephalus was very little known till Dr. Whytt published his *Observations on Dropsy of the Brain* in 1768; but since that period, Dr. Fothergill, Dr. Watson, Dr. Cheyne, and a large number of other writers, have contributed to illustrate its nature.

There are a few cases in which effusion of serum into the ventricles, or into the cavity of the arachnoid, is unaccompanied by any morbid appearance of the brain or of its membranes whatever; and thus there are many instances in which hydrocephalus is not demonstrably inflammatory. More commonly, however, some lesion of the brain or its membrane does exist. Thus the substance of the brain is often marked with more bloody points than usual; the *septum lucidum*, the *fornix*, and other parts forming the walls of the ventricles, are often found in a state of softening—sometimes so soft that Golis gives a case in which water could be expressed from it as from a sponge. The membranes also are sometimes congested, or opaque and thickened, with spots of lymph, evidently the effect of a low inflammation.

The quantity of fluid effused varies from a few tea-spoonfuls to seven or eight ounces, and of this the greater part is generally contained in the lateral ventricles, which from this cause are often so enlarged and distended that the finger placed on the brain,

immediately over the ventricle, is sensible of a distinct fluctuation, while the anterior portion of the fornix is often so raised as to cause a free communication with the third ventricle, and perhaps with the fourth—at least, the effused fluid is found likewise distending those cavities. The quantity of fluid effused between the membranes is also often very great, sometimes filling the whole cavity of the arachnoid as well as the ventricles. Dr. Abercrombie has found serum effused even between the cranium and dura mater, and so also have other observers—a circumstance hardly known in any other disease. The choroid plexus or ventricular membrane, although in general pale and healthy, yet sometimes has the intercellular tissue so infiltrated that it appears studded with small cysts.

The more frequent occurrences are tubercles in the brain or membranes, and some congestion, perhaps, of the mucous membrane of the intestinal canal; but whether the latter is a primary affection, or the result of the violent medicines which are sometimes had recourse to in this affection, is not determined. The peculiar green colour of the stools, so frequent in this disease, seems to be imparted to them in the lower portion of the intestine, the fæcal contents of the upper portion being of a pale drab colour, while the bile in the gall-bladder is of a yellow colour.

The first thing that strikes us on examining those patients who suffer from the chronic form of the disease is the enormous *size* of the head. The adult head averages about twenty-two inches in circumference. Dr. Bacon gives the case of a child whose head at three months had attained the enormous size of twenty-nine inches in circumference, (*Med.-Chir. Trans.*, vol. iii.) The head of Cardinal, a celebrated hydrocephalic man about London, long in St. Thomas's Hospital, and who afterwards died at Guy's, measured thirty-three inches and a half. There are instances, however, in which the cranium has been found unusually small, and of a conical shape, the sutures being closed before birth; and in these cases the children are still-born, or die shortly after delivery. When the disease comes on at later periods of life, and after the sutures are closed, the size of the skull is natural, the cavities within the brain distended, and its substance wasted and anæmic.

The *form* of the hydrocephalic head is also sometimes very irregular, one side being much larger than the other, while the

bases of the orbits are for the most part convex instead of concave, thrusting the eye unnaturally forwards. On cutting through the skull the bones are found to be remarkably thin and transparent. The sutures, although generally closed towards the base of the skull, are commonly separated from each other by a wide extent of membrane at their superior portions. If, however, the patient should survive for several years, the membranous portion becomes ossified by a number of points forming "ossa Wormiana," and the sutures are thus partially closed. In some very few instances the sutures not only close, but the bones of the skull have a morbid thickness.

The membranes of the brain are generally thickened, and the fluid found effused either into the cavity of the arachnoid, into a cyst, or into the ventricles of the brain. When the fluid is contained within the cavity of the arachnoid, the brain is sometimes so compressed that there are instances in which hardly a vestige of that organ remains. A singular and rare variety of this affection occurs when the arachnoid sometimes protrudes through the *fontanelle* or open suture, and the *dura mater* and integuments yielding, a pyramidal bag, with its apex downwards, forms externally, which hangs low down the back like a jelly-bag.

When the effused fluid is contained in the ventricles, those cavities are found exceedingly dilated. The convolutions have no depressions, but appear unfolded. The *corpus callosum* is much raised, the *septum lucidum* is torn and destroyed, or the grey commissure destroyed, and the white commissure elongated to the extent of an inch, so that the ventricles communicate. The parts at the base of the brain also, as the *corpora striata* and *thalami optici*, have scarcely any existence. In fact, the brain seems expanded into a large sac, in which the medullary and cortical substances are so confounded as to be undistinguishable. In Dr. Bacon's case the brain and membranes, even the dura mater, had ruptured, and a probe passed easily through the ethmoid bone into the nose, by whose orifices a considerable dribbling of the fluid took place during life. Golis met with a case in which the water was contained in a cyst the size of a goose's egg, situated between the hemispheres of the brain of a child aged six years, and who died, the cyst being entire.

The quantity of fluid contained in the cranium in cases of chronic hydrocephalus varies from a few ounces to a few pounds. In the case of Cardinal it was found to exceed ten pints (nine pints in the cavity of the arachnoid, and one pint in the ventricles). Other cases have been, however, recorded in which the quantity has amounted to twenty pints.

Authors have greatly differed as to the nature of this disease. Some, considering it a mere increase of fluid from functional activity, have named it *dropsy of the brain*, while others have as constantly referred it to an inflammatory origin; but they have generally concurred in describing an acute and chronic form of the disease.

Symptoms.—Acute hydrocephalus is divided into three stages; the first stage, according to Dr. Cheyne, being that of increased irritability; the second, that of diminished sensibility; and the third, that of convulsions or palsy.

The first stage may be either sudden in its attack, or be preceded for several days by giddiness, so that the child stumbles or falls at play; by a furred tongue, constipated bowels, and perhaps offensive breath. At length the senses of sight and of hearing become morbidly acute; he starts at slight noises—complains of intermitting headache—rests his head on his nurse's lap—occasionally complains momentarily of his head—and then, after a time, rises up and plays again. As this stage advances, the pulse rises, the skin is hot and dry, the urine scanty, the stomach irritable, the bowels constipated, perhaps painful, the stools black and offensive, while the brow is knit, and the pupil of the eye contracted or expanded. The most remarkable feature, however, is a great fretfulness of temper, so that the child is not merely pettish, but quarrelsome. If he sleeps, his sleep is short, uneasy, moaning; he also grinds his teeth, rolls his head, and when he wakes up it is with a scream. "We are led to suspect some deeply-seated evil from the frantic screams and complaints of the head and belly, alternating with stupor, or rather lowness, and unwillingness to be roused" (CHEYNE).

In much of this description some of the phenomena of *meningitis* may be recognized, and, doubtless, a great number of the acute cases are associated with this morbid state already described (page 270, *ante*).

The second stage commences when effusion has taken place.

The pulse, instead of being rapid, is then as slow, perhaps slower, than natural; but this is chiefly when the patient is in a horizontal position, for if he attempts to sit up, it again becomes rapid. The sickness is also abated; nevertheless, the child lies in a state of stupor and of great unwillingness to be moved, with his eyes half-closed, dull, and heavy, or perhaps staring or squinting, the pupil being still contracted or expanded,—and he often suffers from double vision. The stupor, however, is still interrupted by exclamations or shrill piercing screams, while the tremulous hand of the little sufferer is incessantly engaged in picking his nose or mouth.

In the third stage the patient either sinks or recovers. If the event is unfavourable, the pulse again rises, the eye becomes red and dim, and the child, delirious, is often attacked by partial or general convulsions; or one limb or one side may be palsied. From this point the powers of life gradually sink, till at last death closes the scene. If the patient should fortunately recover, the stupor subsides, the countenance becomes more natural, the bowels more regular, the secretion of urine perfectly restored, and at length his health, though long broken, is gradually re-established. The duration of this acute form of the disease is estimated at about three weeks, each stage averaging about a week.

There are two forms of chronic hydrocephalus, the internal and the external, or hydrocephalus in which the membranes protrude. In either case, when this disease is fully formed, whether it be congenital or subsequent to birth, the child is generally of the most feeble intellect, irascible, often epileptic, and of extreme muscular debility, so that, if not palsied, he is hardly able to walk. Dr. Baillie met with an instance of chronic hydrocephalus in a man aged fifty-six, and whose ventricles contained six ounces of serous fluid. His chief symptoms were pain in the head, and a loss of Memory so great that he could recollect only five words, which he continually reiterated to express all his wants. Cardinal, whose case has been mentioned, had more Memory, and he prided himself, says Dr. Elliotson, in being able to say "The Belief," but he usually stumbled when he got to "Pontius Pilate." This man was epileptic, of very feeble intellect, and so irascible as to be always quarrelling with the patients, and would have been extremely difficult to manage except for his muscular debility.

Heberden, however, mentions a case in which eight ounces of water were found in the ventricles of the brain, and yet no symptoms of hydrocephalus existed during life.

Causes.—The remote causes of hydrocephalus are often extremely obscure; but exposure to cold or heat, errors in diet, falls or blows on the head, the retrocession of a cutaneous eruption, or the extension of an inflammation of the ear, are among the most common. Disordered function of the liver or alimentary canal is also a frequent cause, and so is dentition, or the presence of worms; and the circumstance of a child being seized in consequence of its feet having by accident been put into a bath of boiling water will show that any other extreme irritation will equally produce it. Many morbid poisons also will occasion it, as that of *scarlet fever*, of *pertussis*, or of *measles*: of *constitutional* diseases, *tuberculosis* is the most common exciting cause.

The ages of infancy and childhood exercise a most remarkable predisposing influence upon this disease. At those periods the rapid growth of the brain, the irritation of dentition, and the great susceptibility of the nervous system generally, are all powerful causes of determination of blood to the head. The greatest number of attacks, according to Percival, occur between the second and the fifth year; or, as a more general law, the disease occurs from infancy to twelve years of age. Children with large heads and precocious Intellects, and more especially those of a scrofulous diathesis, are its most frequent victims. One warning may be learned from this disease—namely, that it is said to be most common in the children of parents addicted to drunkenness, and from this cause it often runs in families.

Although it has been stated that hydrocephalus may occur during fœtal life, and is more common in the early periods of infancy and childhood, yet adult age is not altogether free from it; and Golis has mentioned three cases of persons attacked in old age, two of whom were above seventy, while the other, perhaps less advanced in life, suffered from this affection for ten years. It seems sometimes to run in families; at least, Frank mentions a family of seven children, all of whom were born with this disease; and Golis another, in which six children were aborted hydrocephalic at six months; while three others, born at the full period, were attacked shortly after birth.

Diagnosis.—Acute hydrocephalus is distinguished from typhoid fever by the screaming, rolling of the head, grinding of the teeth, and by the absence of the peculiar state of the tongue which marks the latter disease. The external characters of chronic hydrocephalus are so extremely marked that it is hardly possible to mistake them. The diagnosis generally is established from the general external appearance and phenomena. There is always intense marasmus, although food may be taken.

There is a morbid state resembling the disease which is neither *acute* nor *chronic*, to which Dr. Watson gives the name of *spurious hydrocephalus*. To three great men of the past we owe our knowledge of this condition—namely, to Gooch, Abercrombie, and Marshall Hall. In children, from a few months to two or three years of age, of small make and of delicate health, from exposure to debilitating causes, this morbid state not uncommonly supervenes. It is indicated by heaviness of the head and drowsiness. The child lies on its nurse's lap unable or unwilling to raise the head. It seems half asleep, one moment opening its eyes and the next closing them again, with a remarkable expression of languor: the eyes are unattracted by any object put before them, and the pupils remain unmoved on the approach of light. The breathing is irregular, sighs are occasionally expressed, and the voice is husky. The tongue is slightly white, the skin is not hot, but sometimes colder than natural. In some cases there is now and then a slight and transient flush. Diarrhœa has often existed for some time, or the child has been severely purged by medicines, or having been weaned, has ceased to thrive since its change of food. When this condition of things occurs in a more elderly child, it has been generally brought about by depletion, by loss of blood, or by medicines. As the more marked symptoms are sometimes ushered in by extreme irritability and a feeble attempt at re-action, cases of this kind (which Dr. Marshall Hall named "the hydrocepha-*loid* disease") have not unfrequently been mistaken for acute hydrocephalus, and treated accordingly, the patient being generally leeched out of its life. In very young children the diagnosis is sometimes very difficult between congestion and exhaustion, between fulness and emptiness.

Dr. Watson, from whom these characteristic notes are taken, suggests the following test:—"As a guide to diagnosis, take notice of the state of the unclosed fontanelle. If the symptoms proceed

from plethora, or inflammation, or an approach to inflammation, you will find the surface of the fontanelle convex and prominent, and you may safely employ and expect benefit from depletion. If, on the other hand, the symptoms originate in emptiness and want of support, the surface of the fontanelle will be concave and depressed; and in that case leeches or other evacuants will do harm, and you must prescribe better diet,—ammonia," brandy in arrow-root, milk from the mother's breast, if possible, and all such means as will tend to foster and nourish an infant."

Prognosis.—The chances of recovery in the first stage are many, if the patient be properly treated. At any subsequent period the prognosis is most unfavourable, and Dr. Cheyne estimates the loss from confirmed hydrocephalus at six to one, and perhaps this is near the truth. If acute hydrocephalus shall unequivocally declare itself, it will be rapid, and almost inevitably fatal (ALISON). The immediate danger in the cases of chronic hydrocephalus is not great, but few patients survive the age of puberty; Cardinal, however, lived to the age of thirty-two. Aurival speaks of another instance which reached forty-five; and Gall of a third who survived till fifty-four.

Treatment.—The acute form of hydrocephalus is only successfully combated in the first or earliest stage. As the first symptoms are those characteristic of inflammation of the brain, and especially of its meninges, there is perhaps no class of cases in which the sanative powers of judicious blood-letting become so apparent as in children in whom the disease has been observed early and carefully watched. Dr. Alison relates the following highly illustrative case:—

"A boy aged eight years, of rather delicate habit, and who had complained occasionally for some weeks of headache and disordered bowels, temporarily relieved by laxatives, calomel, antacids, and a careful regimen, but recurring, and attended with gradually increasing febrile symptoms, and *shooting* pain of head; impatience both of light and sound; pulse gradually rising to 108, distinctly sharp, and beginning to intermit, and then nausea and vomiting, not referable to any medicine taken, but gradually increasing, until it recurred every time that he sat up in bed, for nearly twenty-four hours; and a slight but quite perceptible squint showing itself. The full action of laxatives and one application of leeches, as well as cold to the head, having failed to make any impression

on this course of things, he was bled at the arm (which in such circumstances and at that age has often appeared to me distinctly preferable) to *twelve ounces*, and the blood was sizy. I do not know what further evidence we could have had of the existence of such inflammation within the cranium as would infallibly, if let alone, have gone on within a few days to delirium, stupor, dilated pupil, slow pulse, succeeded by very frequent pulse, convulsions, and death, and have left after it the usual appearances of the *acute hydrocephalus* (of Whytt, Cullen, and Abercrombie, now described), dryness of the membranes on the surface of the brain, distension of the ventricles of the brain with serum, and some of the marks of inflammatory action either on the membranes or surface of the brain. Instead of this, however, I am quite certain that from the time of the bleeding at the arm this boy *never once vomited*, that the intermission of the pulse was *never again observed*, nor did he again complain of lights or sounds. The pain of the head, although less violent, continued in the evening of the same day, and *twelve leeches were applied* within eight hours after the bleeding, and from that time he never once complained of this symptom, nor admitted that he felt it; and *from this moment he recovered perfectly*, and much more rapidly than he had done from much slighter febrile attacks previously; neither has he suffered from that time to this (now thirty years) any return of serious disease" (*Edin. Med. Journal*, p. 777, March, 1856).

In short, all the symptoms vanished in twenty-four hours, most of them during the flow of blood, and never recurred,—a change, under the circumstances, so sudden and sanative as is rarely if ever seen after the use of any other remedy for the same combination of symptoms. With reference to the sanative influence of general blood-letting in children for inflammatory diseases, if performed at the outset, Dr. West observes that such depletion is as important a remedy as in the adult; nor will the most energetic employment of any other antiphlogistic measure enable us to dispense with blood-letting. In a healthy child two years old, a vein (if easily found) may be opened in the arm, and *four ounces* of blood allowed to flow, if faintness be not earlier produced, without our having any reason to apprehend that the plan adopted is too energetic. The immediate effect produced is greater than that which follows local depletion, and the quantity of blood abstracted is less (West, *Diseases of Children*).

The first thing to be done by way of medicine is to purge the patient. The purgative is not of great moment, provided it acts

freely. Some prefer two to five grains of gamboge, others five grains of calomel with thirty grains of compound jalap powder. Such doses are to be followed up by a black draught, or the sulphate of magnesia. So difficult is it to obtain the action of purgatives in this disease, that doses of three times the strength for adults have been in some instances required; but such large doses are never to be given until the inefficiency of smaller ones has been ascertained, (Dr. Watson's *Lectures*, No. xxvi.)

The stools are generally black, or extremely offensive; and this state of the bowels corrected, the disease, if sympathetic, often ceases. If, however, the head be not relieved, some leeches should be applied to the temples, and the head should be shaved and surrounded with some cold evaporating lotion, as with a towel dipped in cold spring water, or in vinegar and water, or in solution of the muriate of ammonia.

If the disease be advanced, no efficient treatment has as yet been determined. The symptoms do not yield to the lancet like those of simple inflammation. *Mercury* has also been used to a great extent, but with little success. In urgent cases, for instance, mercurial ointment has been rubbed on the back and thighs, even in very young children, to the extent of half a drachm to a drachm three or four times in the twenty-four hours. *Calomel* also has been rubbed on the gums to the extent of three or four grains every four or five hours, and it has likewise been given by the mouth in doses of two grains every third or fourth hour. *Mercury* given in these large doses, it must be remarked, seldom produces salivation; for Dr. Clark says he never saw that effect in children under three years of age except in three cases. But the remedy is not successful, and more generally produces *spinach-like* stools, and irritates the alimentary canal. In France the mercurial treatment has been so unsuccessful that some practitioners have even tried a most opposite remedy, namely, *quinine*, but the result has been equally fatal. *Blisters*, *moxas*, and other modes of cauterization have been used as auxiliary treatment, but without apparent benefit.

During the course of the disease the diet should be slops and light puddings.

In congenital hydrocephalus the unassisted efforts of nature seem incapable of effecting a cure, and it is extremely problematical if medicine is of any use. When, however, the case is

deemed hopeless, the propriety of evacuating the water by means of an operation may be entertained. Golis has given the names of twenty-seven writers who have expressed themselves in favour of it, especially if the fluid be slowly evacuated, and at several repetitions of the operation; yet he himself, along with seven or eight others, proscribe it altogether as cruel and useless. But it has been successful; and when the operation is performed, it seems an axiom that the fluid should be allowed to escape gradually, for otherwise extreme faintness and collapse may be expected. In such cases small doses of ammonia, or a few tea-spoonfuls of brandy and water, may revive the little patient. Should re-action take place, however, at a subsequent period, a few leeches and a cold lotion ought to be applied to the head. It seems also determined that the younger the child the greater are the chances of success; for if it lives a few years the sutures of the cranium, though open at the top, are united by bone towards the base of the skull, and thus present a mechanical obstacle to their closure; consequently, the operation is more apt to fail. If this disease should occur in after-life, blisters and mercury to salivation are the remedies mostly relied on.

SUNSTROKE.

LATIN, *Solis ictus;* FRENCH, *Coup de soleil;* GERMAN, *Sonnenstich;* ITALIAN, ——.

Definition.—*An affection of the nervous system, associated with vertigo, and sometimes with headache, or the gradual accession of listlessness and torpidity, with a desire to lie down* (LONGMORE, BARCLAY). *These febrile phenomena may culminate in more or less sudden and complete insensibility, without the power of sense or motion, the breathing rapid, and getting more and more noisy as death approaches. Convulsions of the extremities usher in a complete state of coma, in which the patient gradually dies. The approach of death is indicated by the failure of the heart's action, the fluttering of the pulse, the irregularity of the respiration; and the fatal event may supervene within five minutes to a few hours after the disease has become fully expressed. Death is either by* syncope, apnœa, *or by a combination of the two. In cases which recover, various sequelæ are apt to supervene, such as forms of*

paralysis, more or less complete, choreic movements, melancholia, and other forms of insanity.

Pathology and Symptoms.—This singular and fatal affection of the nervous system has been described under a great variety of names—*e. g., Heat apoplexy, Heat asphyxia, Coup de soleil, Insolatio, Ictus solis,* and lastly, *Erythismus tropicus.* Nevertheless the full expression of the disease not unfrequently occurs at midnight. The name implies a common, and certainly a most powerfully exciting cause of a disease which has been variously and erroneously described as of the nature of apoplexy, or of some form of continued fever.

A very great variety of views have been put forward regarding the pathology of this remarkable disease; and the following account of its nature is based upon the very interesting accounts which have been given by many Indian medical officers, and especially by Deputy Inspector-General Mr. Longmore, when on duty with the 19th Regiment at Barrackpore; by Surgeon Butler at Mean Meer; and by Dr. Barclay, of the 43d Light Infantry, while on the march from Jubbulpore to Calpee.

Instances of the occurrence of *sunstroke,* and the circumstances under which it has been observed to occur, will best convey any idea of the nature of this disease.

One of the earliest accounts of *sunstroke,* in which its nature was distinctly recognized, is that given by Mr. Russell, of the 73d Regiment, while in medical charge of the 68th, in May, 1834. The regiment had then recently arrived in Madras—a fine corps of men in robust health. The funeral of a general officer being about to take place, the men were marched out *at an early hour in the afternoon, buttoned up in red coats and military stocks, at a season, too, when the hot land winds had just set in,* rendering the atmosphere dry and suffocating even under the shelter of a roof, and when the sun's rays were excessively powerful. The funeral procession forthwith advanced, and after having proceeded two or three miles, several men fell down senseless. As many as eight or nine were brought into hospital that evening, and many more on the following day. Three men died—one on the spot and two within a few hours. The symptoms observed (and they were alike in the three cases) were, first, excessive thirst and a sense of faintness; then difficulty of breathing, stertor, coma, lividity of the face; and in one whom Dr. Russell examined, con-

Cf Fatal March June 1870

traction of the pupil. The remainder of the cases (in which the attack was slighter, and the powers of re-action perhaps greater, or at all events sufficiently great) rallied; and the attack in them ran on into either an ephemeral or more continued form of fever. The symptoms of these cases did not more nearly resemble each other than did the *post-mortem* appearances. The brain was healthy in all; no conjestion or accumulation of blood was observable. A very small quantity of serum was effused under the base of one; but in all three the lungs were conjested, even to blackness, through their entire extent; and so densely loaded were they, that complete obstruction must have taken place. There was also an accumulation of blood in the right side of the heart, and in the great vessels (*Medical Gazette*, "Graves' Clinical Lectures," vol. i., p. 181).

A nearly parallel example is related by Sir Ranald Martin as having occurred in the experience of Dr. Miligan, of the 63d Foot, from the exposure of his corps to the sun during a military funeral at Madras. The greater number of the men were in the prime of life; but there were some old soldiers who had served twenty years and upwards in the West Indies, and who were much broken down by service and intemperate habits. The entire corps had just arrived from the Australian colonies, where spirituous liquors can be had on easy terms. The regiment landed at Madras in the month of May; and from the date of the "untoward circumstance" of the funeral, the hospital became filled with cases of fever. Two men dropped down and died on the very day of the funeral, and for several days afterwards the fever cases augmented considerably (*The Influence of Tropical Climates*, p. 205).

The dreadful march of the 43d Light Infantry from Jubbulpore to Calpee furnishes the most instructive and melancholy examples of *sunstroke*. It must be remembered that the regiment had previously marched throughout the greater part of the length of the Madras Presidency—a march extending from the 24th December, 1857, to the 17th of April, 1858, when the regiment arrived at Jubbulpore. During this first march the regiment enjoyed great immunity from sickness, owing to the sanitary precautions which had been taken. The march, however, told seriously upon the men in general. They lost condition, and in a great measure their robust appearance, and were in urgent need of rest. But after a

rest of five days only, they had to commence the march from Jubbulpore to Nagode, a distance of 163 miles, arriving there on the 8th of May. The heat on the march was excessive, and it told very much on the health of the men, already exhausted as they were by a previous march of almost unexampled length. After having been *four months and thirteen days in the field, and after they had marched* 969 *miles*, a fatal case occurred; and from that date cases of *sunstroke* gradually increased in frequency. At Nagode the regiment remained eight days; and although the indications of exhaustion in the altered looks of the men, their loss of flesh, and their evidently failing strength, were so obvious that they forced themselves on the observation of every one, *yet the men were ordered to continue their march to Banda.* The periodical hot winds were blowing at the time day and night, with scarcely any intermission, and the heat of the weather was almost unbearable. After leaving Nagode they were obliged to encamp for four days in the bottom of a deep and narrow ravine, with nearly precipitous sides upwards of a mile in height. The heat in this valley was insufferable, and exceeded anything the regiment had ever been exposed to before, or that they were exposed to afterwards. The thermometer varied during the day from 115° Fahr. to 118° Fahr. in the largest tents, and in the smaller ones it reached 127° Fahr. Night brought but little relief. On one occasion Dr. Barclay observed the thermometer standing at 105° Fahr. at midnight. Such was the overpowering effect of the heat in this "valley of the shadow of death," that even some of the natives were struck down, and died with all the symptoms of *sunstroke* in less than an hour. The number of cases among the men of the regiment, especially during the first day, was very great. They were carried into the hospital tents at every hour of the day and night; and although a large proportion of them recovered, two officers and eleven men were buried under one tree in the neighbourhood of the camp. Marching was resumed on the 24th of May. On the 27th the regiment arrived at Banda, a distance of about 100 miles from Nagode, having lost during the march two officers and nineteen men.

The health of the regiment improved daily during a short stay at Banda; but the men were still in a miserable state of exhaustion when the regiment again began to march for Kirwee on the 3d of June. At Kirwee five men died from *sunstroke,* and on the

return to Banda two more died. The regiment now marched for Humeerpore on the 28th of June, *en route* for Calpee. The weather was again excessively hot, and the men suffered very severely. They were by this time completely worn out and prostrated. There was scarcely a man in the regiment whose strength was not reduced to a level with that of a child; and the officers were not in a very much better plight. Many men broke down altogether, and had to be carried as it could best be managed—in *doolies*, in sick carts, or on baggage and commissariat carts after they were filled. It was painful to see many others who, a few months before, had been in robust health and full of vigour, staggering from weakness as they endeavoured to keep up with the column, throwing themselves down completely exhausted at every halt, and scarcely able to rise from the ground when the "*assembly*" sounded. Calpee was reached on the 5th of July, and between the 28th of June and the 7th of July one officer and five men had died.

These details are given for the purpose of showing *the effects of protracted exposure to intense heat in a body of men in the field debilitated by fatigue and want of rest.* It may now be shown how the effects of protracted exposure to intense heat in a body of men may operate upon them when in *quarters;* as described by Deputy Inspector-General Longmore. He records sixteen cases of *sunstroke* as having occurred in the 19th Regiment between the 23d of May and the 14th of June, 1858, when they were quartered at Barrackpore. The period was marked by an unusually elevated degree of temperature, and generally by great dryness of the atmosphere. The quarters were of a temporary and imperfect nature, some of them being merely hired *bungalows.*

Of the sixteen cases, five occurred in non-commissioned officers, and eleven in privates of the regiment, the proportion attacked being greatly more among the former than among the latter: their occupations, especially when on orderly duty, caused them to be more exposed than the men with whom they lived. Simple exposure to the external atmosphere and the solar rays were not of themselves sufficient to induce the disease. Of the five non-commissioned officers attacked, two were on duty at the time as orderly serjeants; one had had fever for several days, but had not been exposed to the sun on the day of attack; one had been slightly exposed; the fifth not at all. Of the privates, eight were

attacked by the disease within doors, and three while on sentry. No cases occurred of sudden sunstroke — *i. e.*, of insensibility instantly induced by the direct rays of the sun in a man previously healthy.

The characteristic feature with regard to atmospheric temperature, when Mr. Longmore's cases were observed, was the little variation of it night or day. There was no rain; and the ground and buildings became so heated that, long after sunset, the radiation of heat maintained a high temperature within doors. Prolonged high atmospheric temperature was recognized as the essential cause of the attack; but nervous depression from solar exposure, fatigue, and previous illness were associated with that prime or essential cause.

But a most important element of causation is still to be mentioned—namely, *the influence of vitiated air when men are congregated without sufficient ventilation.* One-third of the cases, and nearly half the deaths, occurred under such circumstances; so that, *in quarters,* the predisposing causes of *sunstroke* may be comprised in the following conditions:—(1.) Prolonged atmospheric heat, with a dry and rarefied state of the air; (2.) Nervous exhaustion; (3.) A contaminated atmosphere (LONGMORE, TAYLOR); while (4.) An increase of the average prevailing temperature sufficed to act as the more immediate exciting cause for the development of *sunstroke.*

The experience of Surgeon Butler at Mean Meer has led him to write, that "when the thermometer ranges beyond 98° Fahr. in crowded barracks, cases of apoplexy almost invariably occur." Dr. Crawford also, in writing on *sunstroke,* notices an electric condition of the atmosphere as influencing the respirability of the air, and refers especially to that peculiar state "in which the hairs of a horse's tail repel each other, in which the hairs of the head stand on end, in which a man exposed to its influence becomes irritable, headachy, and restless, without knowing exactly what is the matter with him. Such a state of atmosphere will generally be found to exist in localities where cases of *sunstroke* occur, whether such localities be the crowded barrack, in the still more crowded cantonment, the tented field, or the march in column through the still valley, the deep gorge, or the thick forest." Dr. Barclay notices that cases of *sunstroke* occur with increased frequency immediately before a thunder-storm,

and that they cease as soon as the electrical discharge has taken place.

From the accounts given by these several observers it seems clear, as Dr. Barclay observes, that the symptoms of the disease are liable to be greatly modified by accidental causes, and that those phenomena which are most prominent under one set of circumstances are either absent altogether under another, or so very much less urgent as scarcely to attract observation—that the disease, in fact, varies in several important points according to the nature of the circumstances in which it occurs.

The phenomena which at any time have presented themselves under the various circumstances detailed by Mr. Longmore, Dr. Barclay, and others, may be summed up as follows:—When careful observations are made, the affection seems gradually induced by protracted exposure to extreme heat in a dry and rarefied air, combined with a vitiated atmosphere from defective ventilation, or with physical exertions of an arduous character, implying excessive fatigue of extreme duration, so as to bring about great debility and weariness of the body. Sleep at last cannot be obtained, or it is greatly interrupted, and of short duration. Deterioration of the general health is thus progressive, while altered looks and loss of flesh indicate extreme exhaustion. The skin becomes rough and scaly, and perspiration ceases. The heat of the surface increases to an intense degree; but accurate records of the temperature of the body in cases of *sunstroke* are not yet in existence. The bowels tend to become obstinately constipated. The urine becomes copious, and the calls to pass it are frequent; or even incontinence may prevail (LONGMORE, BARCLAY). Under such circumstances those morbid phenomena intervene which are noticed in the definition.

Most observers are agreed that intemperance cannot be charged with being the immediate exciting cause of the disease, although it is a universally acknowledged predisposing cause. The men of Dr. Barclay's regiment were extremely temperate, robust, and well-formed men; and Mr. Longmore gives a no less favourable account of his men as to temperance. The drunkard, indeed, is rarely to be found in the ranks under circumstances favourable to the development of *sunstroke*. He is either in prison, or skulking at some depôt, or in some hospital, where he may be left for want of transport; or, if with a regiment, "the pains" come on oppor-

tunely, to save him from fatigue and danger. The vascular system of a habitual drinker soon shows unmistakable indications of over-stimulation in the suffused eye, the bloated countenance, the profound sleep which follows the slightest indulgence, and the subacute meningitis which sooner or later supervenes in India (CRAWFORD). Such are not the kind of cases which furnish the deaths from *sunstroke*. When exposed to the stimulus of a tropical sun, such cases may sink under it, as they would under any other great excitement; and a debauch or an ephemeral fever will alike predispose a man to an attack of *sunstroke*, inasmuch as both may bring about that state of nervous depression which seems essential to the occurrence of this disease.

In Dr. Barclay's experience the deterioration of the health of his men in the field was progressive. For a long time before the occurrence of the first case of *sunstroke* every one had suffered more or less from "prickly heat," the severity of the affection being, as a rule, in proportion to the amount of perspiration from each individual; and when the heat of the weather became still more intense, one of the first symptoms of its producing an injurious effect was the gradual disappearance of this cutaneous eruption, the skin becoming rough and scaly, and the perspiration ceasing. In many cases the interruption of perspiration appeared to be complete—not the slightest feeling of dampness being perceptible in any part of the dress at any period of the day. On this point Dr. Simpson observed to Dr. Morehead,—"Every man seized with sunstroke, and who could answer questions, informed me that he had not perspired for a greater or less extent of time,—sometimes not for days,—previous to being attacked, and that he had enjoyed good health as long as he perspired, but that on the perspiration being checked, he felt dull and listless, and unable to take much exertion without making a great effort" (*Researches on Disease in India*, p. 617). The heat of the surface became at the same time much increased. The bowels became obstinately constipated. The appetite gradually failed; and a feeling of nausea was generally complained of, the sight of food often exciting loathing. In other instances there was nearly complete anorexia.

The urine became copious and limpid, and the calls to pass it frequent; so much so that Mr. Longmore especially notices a frequent desire to micturate as constant in all the cases in which

there was an opportunity of ascertaining the point; and he justly remarks—"If this symptom should prove to be a general precursor of the attack, it might be rendered valuable as an indication of the approaching danger, which, by early and proper care, might then probably be averted; and its presence at a time when heat-apoplexy was prevalent would make the surgeon alert to obviate the more serious symptoms which might be expected to follow." (*Indian Annals*, vol. vi., 1860, p. 399). Sleep from the first was much interrupted, and the periods during which it could be obtained became gradually shorter, until at length no sleep could be got during the night. The pulse was frequent, sharp, and small. The tongue white posteriorly, but seldom foul or dry. Thirst was seldom very urgent. Vertigo was frequently complained of, but headache rarely; and, as a general rule, there was no complaint of pain. The general complaint was extreme debility, weariness, and prostration on any exertion; vertigo, nausea, and in many cases incontinence of urine, more particularly after exposure to the sun, "I cannot hold my water," being a very general answer to the first inquiries of the medical officer. These premonitory symptoms were attended with rapid and progressive emaciation. No one during the march (in the ravines of Northern Bundelcund, so well described by Dr. Barclay) became the subject of *sunstroke* without having previously suffered from some or all of these premonitory phenomena. Such phenomena, however, prevailed in a much larger proportion of cases in which symptoms of *sunstroke* did not supervene at all; and they seem to stand somewhat in the same relation to *sunstroke* that the premonitory diarrhœa does to *cholera*.

The attacks of *sunstroke* came on generally when the men were in their tents, during the day sometimes, but in several instances during the night, and only in one instance on the line of march. The patient had generally been lying down, often seemingly asleep, or trying to induce sleep, when the attention of his comrades would be directed to him by his hurried and heavy breathing, and on attempting to rouse him he was found to be insensible. In other instances he started up suddenly, and attempted to escape from the tent, staggering about, and struggling violently when laid hold of, evidently much alarmed, and anxious to escape from some imaginary object of terror; but in a very few minutes he became insensible.

In one or two instances the first symptom of the disease was reputed to have been an uncontrollable burst of laughter, without any apparent cause, and in sad enough circumstances,—insensibility and death speedily following. In a few instances the patient would come to hospital himself, or with the assistance of his comrades, exhibiting some of the symptoms (premonitory) already detailed, when insensibility or a tendency to sleep would gradually supervene. The time of the day at which most of the cases occurred is important in connection with the elevation of temperature. Ten out of sixteen cases occurred between the hours of 2 and 5 o'clock P.M., and five cases between 5 and 9·30 P.M. (LONGMORE). In Mr. Cotton's experience at Meerut the seizure usually happened towards evening. The thermometer generally indicated the maximum temperature of the twenty-four hours to be about 4 P.M.; and the variation in the thermometer-range was very slight from 2 P.M. to sunset; and even for some hours after sunset the temperature scarcely at all declined (LONGMORE).

When the disease was fully expressed, the symptoms were constant and regular. The patient lay on his back, without sense or motion, breathing rapidly, and as death approached, more and more noisily, from the vibration of the *uvula* and the *velum pendulum palati;* and although such *stertor* was present in most of the fatal cases, yet it never approached in degree to that which is common in true apoplexy. The eyes were *fixed, and turned slightly upwards,* becoming gradually more and more glassy, as if from the formation of a film over the cornea; the *pupils greatly contracted* (generally to the size of the head of a pin); the *conjunctivæ pinky, the colour gradually becoming deeper;* the congestion at first deep-seated, and the first symptom of it a pinky zone around the cornea, the superficial vessels afterwards becoming affected. *The face was invariably pale;* the surface dry, harsh, and burning to the touch, far beyond what Dr. Barclay ever felt in any other disease. The heat of skin greatly exceeded that occurring in pneumonia, and was without parallel in the experience of Mr. Longmore. The *heart's* action was very rapid and sharp (BARCLAY), excited and irregular (LONGMORE), the impulse and pulsation in the carotids being perceptible to the eye from a considerable distance. The pulse was frequent and sharp, and at first moderately full, giving the idea of a thinner fluid than blood circulating beneath the finger. Frothy mucus, sometimes clear,

at other times of a brown colour, was in most instances ejected from the mouth and nose for some time before death, and often in large quantity.

When the disease was about to terminate fatally, the heart's action soon began to fail, the pulse to flutter, and the breathing to be irregular; and in a period varying from a few minutes to a few hours, death closed the scene. In nearly all the fatal cases there was occasional convulsive muscular movements of the extremities up to the time of death. These generally ushered in a state of complete coma, in which the patient gradually sank (LONGMORE).

In a large proportion of the cases, however, from the commencement of the attack to its termination in death, the patient never moved a limb, or even an eyelid; and a comparatively small number of the cases on the march from Jubbulpore to Calpee were from the first attended with convulsions. These generally began in the upper extremities, or in the muscles of the face, and in some cases they did not extend farther, the patient either becoming rapidly insensible or recovering. In other instances they extended to the whole of the voluntary muscles, and were of the most violent description, ceasing frequently for from two or three to fifteen or twenty minutes, and recurring again with increased severity. In a few instances the nervous irritability seemed as much increased as in hydrophobia; and some patients appeared to be in a state analogous to *somnambulism*. Although unconscious, and incapable of understanding or of answering questions, yet the countenance indicated the greatest terror,—the eyes rolled wildly about; and a few drops of water poured on the ground near him were sufficient to throw him into the most violent convulsions, and to elicit from him screams of agony. In most of these cases the convulsions ceased some time before death. The symptoms then became identical with those which characterize the ordinary course of the disease. In a few, however, the convulsions continued to the last; and in one or two death took place when the body was still contorted by them (BARCLAY).

The mortality from *insolatio* is equal to 42·734 *per cent.* (BARCLAY); or 43·3 *per cent.* (BUTLER); one-half the cases (SWIFT).

In the cases which terminate favourably a gradual remission of the urgent symptoms takes place; but the irregularity of the

heart's action and oppressed breathing may persist during the next day; and if the patient has been exposed to the influence of malaria, paroxysmal febrile phenomena may supervene.

The patient cannot be considered free from danger till the skin becomes cool and moist (SIMPSON, BARCLAY); indeed, a relapse of all the worst phenomena may occur even after free perspiration and sleep has been procured. Dr. Crawford relates such a case:—An orderly being left in charge of the patient during the night, with instructions to keep a cold lotion to his head, and to call the surgeon in the event of any change occurring, no matter how slight; the surgeon, visiting the hospital at one in the morning, when summoned to see another patient then taken ill, found the orderly asleep, and, to his horror, his patient moribund,—the face swollen, of a dark livid colour, the eyes protruding from their sockets, with stertorous breathing and spasmodic twitchings of the muscles of the chest and arms. He died shortly afterwards.

Morbid Anatomy.—In Mr. Longmore's cases, in which a vitiated atmosphere, from the want of ventilation, was associated with the extreme heat, the appearances after death were those usually found in death by asphyxia—namely, excessive engorgement of the lungs, amounting to complete obstruction of the pulmonary circulation. Some parts of the lungs had all the appearance of true interstitial apoplexy. Cerebral congestion was less marked in character and less constant in amount, and it seemed to be secondary to the failure of the due performance of pulmonary functions, resulting, perhaps (as Mr. Longmore suggests), from loss of tone in the vessels, and from the enfeebled action of the heart, consequent upon the imperfectly oxygenated blood it was receiving. The congestion of the head was generally expressed by engorgement of the vessels of the *pia mater* and *choroid plexus*, and by numerous *blood-puncta* in the substance of the cerebrum, as shown on section. The appearance of the brain indicated generally sanguineous determination without serous effusion; and when serous effusion had taken place, it was generally into the cavities of the lateral ventricles, and sometimes into the subarachnoid space. The blood is always fluid (MOREHEAD).

Various opinions are entertained with regard to the mode of action of the various agents which combine to produce this singular affection of the nervous system. The phenomena during

life and the *post-mortem* appearances are in accordance with death from coma, slowly induced, or from syncope. The manner in which heat acts in the production of such asphyxia as is seen in cases of *sunstroke* has been variously interpreted by writers on the subject; and observations are very much to be desired as to the exact range of temperature of the body-heat in such cases. It is known, however, to be excessive; and the increased temperature of the blood, which results from prolonged exposure to great heat, must have a deleterious influence upon the constitution during the metamorphosis of tissue going on under such circumstances. Intense heat applied to the whole body tends to produce death by *syncope*, as in concussion of the brain (ALISON). Heat acting on the peripheral distribution of the nerves, and accumulating in the system, as it seems to do in *sunstroke*, produces such an effect on the heart, the lungs, and the brain, as to produce the phenomena of *syncope* and *coma*.

The pre-existing cutaneous derangement in all the cases, the total inaction of the skin, its dryness and intense heat, betoken an accumulation of heat in the blood which cannot fail to influence the delicate textures of the brain and lungs. The "embarrassed and heavy breathing;" the "sense of weight over the sternum" (LONGMORE); the "hurried and heavy breathing" (BARCLAY); the "catching at the chest;" the "constricted feeling, as if of approaching suffocation, caused by wind at a temperature of 112° Fahr." (M'GRIGOR), indicate that physiological state of "*anxietas*" which prompts to such acts of inspiration as are seen on the approach of *syncope*, or of *apnœa*, from depression of the nervous influence of the *medulla oblongata*.

Pollution of the blood, from the prolonged continuance of function under such circumstances as impair the normal action of the skin, the lungs, and the kidney, produced by the atmospheric conditions already described, and the phenomena of the disease in its severe form, denote the culmination of functional efforts to get rid of the rapidly accumulating elements of disintegration which must have resulted—as indicated by progressive emaciation, augmentation of animal heat, and total suppression of the cutaneous function. Cases of sunstroke occurring "in quarters" seem under such circumstances to die from *coma*, inducing *apnœa;* and the most common complication is undoubtedly pulmonary congestion from oppression of the *medulla oblongata*, evidences

of which are found on *post-mortem* examination in the majority of fatal cases, as originally pointed out by Dr. Marcus Hill (*Indian Annals*, vol. iii., October, 1855); and afterwards by Mr. Longmore (l. c., vol. vi., July, 1859, p. 396). In those cases of death by *coma*, the most striking point in the *post-mortem* appearances is the enormous congestion of the lungs; in which Dr. Parkes remarks, that although he has dissected men in a very large number of diseases, both in India and in England, he has never seen anything like the enormous congestion observed in two or three cases of this kind (*Practical Hygiene*, p. 345).

Pulmonary engorgement, however, is not always present. On the march and in the field the functional phenomena are chiefly of the cerebral, spinal, and sympathetic systems, as indicated by a painful state of nervous irritability from over-stimulation of intense heat. The long exposure of the eyes to the glare of the sun in camp may account for the more constant occurrence of their congested state in cases of *sunstroke* in the field, compared with such cases occurring in quarters.

The pallor of the face and of the surface generally seems also to be more an attribute of the disease in the field than in quarters, the cases being probably more anæmic in the field and more plethoric in quarters (BARCLAY). Practically, it has been observed, as Dr. Barclay points out, that there are at least four different ways in which death may occur in cases of *sunstroke*, which are necessary to be borne in mind with regard to the line of treatment necessary to follow.

(1.) The affections of the nervous system alone, more particularly those which occur during active exertion "in the sun," when the intense heat acts on the surface with the greatest power, producing at last a condition similar to severe concussion, and more or less instantaneous death by *syncope* (ALISON, CRAWFORD, BARCLAY, MOREHEAD). (2.) Death may be prolonged, when pulmonary complication may occur from destruction, more or less complete, of the pulmonary circulation, and death by *asphyxia* ensues. Or, (3.) There may occur cerebral congestion, and death by *coma*. These states may, and generally do, co-exist together; and symptoms of either may predominate. (4.) Recovering from the immediate effects of these conditions, the patient may die two or three days afterwards, a febrile attack succeeding, with serous effusion within the cranium.

Causes.—Heat, and atmospheric conditions of the nature already indicated, seem to concur with the following predisposing circumstances to induce cases of *sunstroke:*—(1.) Plethora and unacclimation; (2.) Debilitating causes of every kind, particularly such as lower the tone of the nervous system or increase its irritability—*e. g.*, excessive fatigue and prolonged exposure in extreme temperature, prolonged marches, bad ventilation in tropical temperatures; (3.) A febrile state, from whatever cause. As a general rule, Dr. Barclay found that plethoric men incur greater danger from exposure than others; (4.) Intemperate habits; (5.) Exposure to an atmosphere highly charged with electricity (CRAWFORD, BARCLAY); (6.) During the season of prevalence of sunstroke the temperature would seem to have ranged from 96° to 120° Fahr. in the shade—extremes of atmospheric heat chiefly observed on the Coromandel Coast, Central India, the North-West Provinces, Scinde, and the Punjaub (MOREHEAD, l. c., p. 615).

The effects of the constant stimulation of excessive heat in producing nervous irritability and pervigilium cannot be doubted (MARCH, BARCLAY), and Indian medical officers can bear witness, from personal experience, to the extreme misery resulting from such excessive stimulation, in combination with the conditions already mentioned.

Treatment.—Keeping in view the nature of this disease, and the various modes in which death may approach, the line of treatment may be indicated as follows, on the authority of Dr. Barclay:—

With regard to the class of cases in which death tends to occur suddenly from *syncope*, there is little opportunity afforded for treatment; but the measures indicated are—the *cold douche*, keeping the surface wet and exposed to a current of air, or assiduously fanned, exclusion of light as far as possible, the immediate employment of stimulants, external and internal, by the rectum as well as by the mouth. *Depletory measures of any kind are not to be thought of.* In the less rapidly decisive cases prompt treatment is of the greatest use; while delay is fraught with the greatest danger. The patient must be immediately stript of his outer clothing; and, being placed in a semi-recumbent position, the cold douche is to be applied, from a height of three or four feet, over his head and along his spine and chest, his extremities

being at the same time sponged over with cold water. Relaxation of the pupil is the first symptom that shows the good effect of the treatment, which may require to be repeated several times, on account of returning insensibility; but if there is any evidence of failure of the pulse, this treatment must be discontinued, and the application of cold to the head is then all that can be borne. The hair is to be cut short as soon as possible, and a blister applied to the nape of the neck, the surface having previously been well sponged over with the *acetum lyttæ*. When the first violence of the attack is subdued, increasing confidence in the ultimate result may be indulged in so soon as vesication takes place; and in cases where insensibility recurs after an interval of ten or twelve hours, it may be removed by the application of a second blister to the vertex; and which may be again repeated, there being no doubt as to the good effect it produces. A blister may also sometimes be applied along the spine in the worst cases. Stimulation by the use of the electro-galvanic current, with the moist sponges applied along the sides of the neck, chest, and epigastrium, ought also to be employed. *Sinapisms* ought generally to be applied to the extremities, and to the chest or sides.

As soon as possible after the employment of the douche, a strong purgative enema ought to be given, those of a stimulant nature being preferred (such as those indicated at pages 325, 326). But as the enema may have to be repeated several times before any effect is produced on the bowels, it may be advisable to let the first enema be of a simple purgative character; and afterwards let it be followed up by turpentine enemata.

If cerebral congestion is indicated by the state of the eyes already described, a few leeches to the temples may relieve the congestion (LONGMORE, BARCLAY); but the prevailing opinion among officers of experience in the treatment of this disease is against the employment of blood-letting by venesection, even in severe cases. In all the cases which have been recorded, in which it has been employed, it seems to have been generally hurtful, and to have hastened the fatal termination.

In cases where the breathing is much oppressed, and the bronchial tubes loaded with mucus, the patient should be turned occasionally over on his face and side.

In the convulsive form of the disease, where the greatest irritability of the nervous system prevails, the douche is found

to be inadmissible, from the agony which it occasions; and in such cases Dr. Barclay has found great benefit from the inhalation of chloroform. After a few inspirations the convulsions for the most part ceased, and sleep was very easily induced; but in one or two instances, after a considerable interval of consciousness, febrile symptoms increased in severity, coma supervened (probably effusion having occurred within the cranium), and was followed by death. But the cases in which chloroform can be used are comparatively few; and very great care is necessary in its employment, so that the inhalation may be suspended at once, as soon as any effect is produced upon the pulse.

Measures for the Prevention of Sunstroke.—(1.) All weak and sickly men should be weeded out and left behind, if a march is to be undertaken during hot weather in India; (2.) The costume should be suitable for the early morning hours before sunrise, as well as for the scorching period which follows, when the men are for the most part in their tents. It should consist of materials of slow conducting power, of a colour by which heat is not readily absorbed, and should be as loose and light as possible. A flannel shirt should be worn, to prevent the men being exposed to sudden chills, and a flannel belt round the loins may be worn with advantage, except in the hottest weather. The shirt-collar should either be open, or made so wide as to prevent all risk of its pressing injuriously on the veins of the neck. Above all, some other form of knapsack should be devised than that at present in use. Competent authorities, strongly urged by Dr. Parkes, have devised a pack which is a great improvement on that now in use, and which does away with the use of cross belts over the chest, so injurious to the functions of the organs within the chest. The march ought not to be commenced too early in the morning. The troops should be on the *new* ground about an hour after sunrise, and the pace should never exceed three and a half miles an hour. There should be a halt for seven or eight minutes every hour, or oftener if the men are exhausted, and a longer halt half way, when each man should have a cup of coffee and a biscuit. They ought also to have their ration before starting in the morning. An ample supply of water should be provided for the men by "*bheesties*" being attached to each company, and always compelled to march with it. No man should be allowed to fall out without being accompanied by a non-commissioned

officer, whose duty it should be to bring him to a medical officer at once, if sick, and if not, to bring him up to the column at the halt. All men so falling out should be brought up to hospital tents for examination immediately on the arrival of the regiment in camp. The men should carry nothing on the march but their rifles and ammunition—the quantity of the latter being kept as small as is consistent with safety. They should be allowed to march "easy" and loosely clad, more particularly in passing through jungles or ravines. No halt should ever take place on such ground when better may be had within a moderate distance. When the sun is up, halts should be so timed that shelter may be obtained by open *topes* of trees. Camps should be formed on as high and open ground as possible. The sites for camps in India, marked out by the "official" pillars, are generally the most objectionable that could have been selected (BARCLAY, INDIAN SANITARY COMMISSIONERS, and others). As much space should be allowed between the tents as the ground will admit of. Tents should be pitched as speedily as possible, camels and elephants being provided for their transport—carts never. "*Kus-kus*" mats should be kept constantly wet.

Troops in the field during the continuance of the hot winds in India should have the best description of tents that can be got for hospital purposes, and be provided with the best known means for keeping them cool. An abundant supply of water in camp is of the utmost importance, care being taken that the bags containing it are in good repair, hung up within easy reach of the men, and kept always filled with water. Sentries should be under cover during the heat of the day; and the men should be instructed, whenever they go out in the extreme heat of the sun, to put a wetted towel or thick handkerchief over the head, under the cap, and around the back of the neck and face. The men should be encouraged to take exercise during the cool of the evening; or, at all events, to leave their tents, so as to permit of their thorough ventilation; and wherever it is practicable, bathing should not be omitted.

Rations of spirits ought certainly to be discontinued in India. It may be a question as to what should be substituted instead; but all authorities are agreed that the system of "spirit rations" tends to convert young soldiers into drunkards.

The sleeplessness which sometimes is a premonitory symptom

of the disease has been relieved by opium, *provided there were no evidence of commencing insensibility,* and followed by a purge, if necessary (M. WRENCH, late 12th R. Lancers).

INSANITY.

Definition.—*A mental state in which acts of Conception, Judgment, or Reasoning persistently express themselves as different from the states of Feeling and modes of Thought usual to the individual in health* (COMBE). *There is then a deficient, impaired, or perverted power of the Will, or an uncontrolled violence of the Emotions, with perverted Sensations and Instincts. Such complex mental states are separately or conjointly produced by disease of the brain, ordinarily of insidious approach, generally without fever, and resulting from specific morbid action of the hemispherical ganglia, and tending to become chronic or persistent. Such conditions render the patient legally an irresponsible being, and unfit him eventually for the performance of the social and political duties of life* (ESQUIROL, WINSLOW, BUCKNILL, TUKE).

Pathology and Morbid Anatomy.—Many theories have been propounded to explain the nature of Insanity. They may be resolved into two, as at present entertained, namely,—(1.) The *metaphysical, functional,* or *spiritual* theory; and (2.) The *cerebral* theory.

The "functional" or "spiritual" theory, which inculcates the belief that Insanity is an affection of the immaterial principle, is at variance with all reasoning. Such a belief is in direct opposition to positive, well-recognized, undeniable data. It is an almost universal belief that the brain is the material instrument by which that thinking principle, the Mind, manifests itself, whether it be by the unseen phenomena of *Conception, Judgment, Reasoning,* and *Instinct,* or by the more obviously expressed phenomena of *Volition, Emotion,* and *Sensation.* To consider, then, those *subjective* phenomena which collectively, in their various manifestations, constitute "Mind"—an immaterial essence—as liable to disease apart from all derangement of the material organ, the instrument with which it is so closely and indissolubly united—is to believe in a most incongruous, unphilosophical, unphysiological doctrine. The more consistent theory

is that which is known as the *cerebral theory;* and which is now entertained by most of those eminent physicians who have made Insanity a special study and subject of treatment. Among the most able exponents of this theory in our country may be mentioned Drs. Forbes Winslow, Bushnan, Conolly, John Charles Bucknill, Daniel H. Tuke, Laycock, and Lauder Lindsay; and from their lucid descriptions of the insane I have drawn up the following account of Insanity, sufficient for the scope of this text-book.

The belief which this so-called *cerebral* theory inculcates is, that the instrument through which the phenomena of Mind are expressed is the part diseased;—that the encephalic nervous textures are primarily implicated. And as it is consistent with the pathology of disease in every other organ and texture of the body, that the part may be diseased without our means and instruments of research being able as yet to demonstrate such morbid state to the senses, the diseased state being expressed through one or more disordered functions of the frame; so is it with the brain. It is an organ of such exquisite delicacy, both of structure and of function, that important and extensive structural changes may, and often do exist, which neither our naked eye-sight nor our touch can appreciate, and which can only sometimes be demonstrated, if at all, by various complex methods of research.

In those cases, also, of Insanity where the manifestations of the mental phenomena are simply disordered and perverted, but not abolished, it is consistent with the known pathology of disease in other parts to expect *the very slightest* structural change, such as may rather be expressed as a *tendency* to those morphological lesions which occur between the blood and the elements of texture, and which are only manifested through vital phenomena —insidious, because unseen in their approach—and often inappreciable after death to the most experienced observers. Analogous to this morbid state in the nerve-tissue of the brain is the local morbid state which attends that complex morbid process known as *inflammation,* and to that essential part of it to which Virchow gives the name of *parenchymatous.* It is expressed in the altered vital morphological phenomena between the blood and the minute elements of tissue, and which, in some textures, has been appreciated by the microscope as a mere "cloudy

swelling" of the minute elements of tissue, such as may be seen in cartilage and in some of the so-called non-vascular tissues.

The phenomena of Insanity also offer the most conclusive data showing that the brain-tissue is impaired, especially in those cases where the manifestations of Insanity obviously yield to remedies.

Those pathological doctrines are, moreover, always to be regarded with distrust whose tendency is to hold out no hope of cure. Such is the tendency of the *metaphysical* theory of insanity.

Believing in the *cerebral doctrine*, and acting upon it, the prospects of cure are hopeful, *if the case is diagnosed early, and remedies are judiciously applied.*

"If cases of Insanity are brought within the sphere of medical treatment in the earlier stages, or even within a few months of the attack, Insanity, unless the result of severe injury to the head, or connected with a peculiar conformation of chest and cranium, and in hereditary diathesis, *is as easily curable as any other form of bodily disease for the treatment of which we apply the resources of our art*" (WINSLOW).

It is a serious error, on the one hand, to act upon the belief that *physic cannot make a man think otherwise*, when "one man thinks himself a king, another a cobbler, and another that he can govern the world with his little finger." On the other hand, it is equally erroneous to act upon the belief, "*that no man was ever reasoned into Insanity or reasoned out of it.*" It is only by a proper combination of *medical* and *moral treatment* that the first manifestations of Insanity are to be controlled and ultimately effaced.

"The existence of so vast an amount of incurable Insanity within the wards of our national and private asylums is a fact pregnant with important truths. In the history of these unhappy persons—these lost and ruined minds—we read recorded the sad, melancholy, and lamentable results of either a total neglect of all efficient curative treatment *at a period when it might have arrested the onward advance of the cerebral mischief*, and maintained Reason upon her seat, or of the use of injudicious and unjustifiable measures of treatment under mistaken notions of the nature and pathology of the disease. . . . Experience irresistibly leads to the conclusion that we have often in our power the means of curing Insanity, even after it has been of some years' duration, *if we obtain a thorough appreciation of the physical and mental aspects of the*

case, and perseveringly and continuously apply remedial measures for its removal" (Winslow in *Lettsomian Lecture*, pp. 59, 61).

The testimony from morbid anatomy which illustrates the pathology of Insanity, and which more directly supports the cerebral theory, is that which has resulted from observations made upon the *bulk* of the brain, upon its *absolute* and *specific* weight, and upon the relative bulk and weight of the grey and white substance of which it is composed. The original observations of Dr. Bucknill with regard to the *insane*, and of Dr. Sankey with regard to the *sane*, furnishing especially valuable data for comparison, are those which must be regarded as the initiative of observations from which we hope yet to learn much. Dr. David Skae, of the Morningside Asylum, near Edinburgh, and Dr. Boyd, of the Somerset County Lunatic Asylum, have more recently confirmed some of these observations, already noticed at page 253, *et seq.*, and have in some measure extended them. Such observations show generally,—(1.) That the absolute weight of the brain is slightly increased in the insane—a conclusion which is also consistent with the fact, established especially by Bucknill, that in many cases of Insanity the absolute *size* of the brain is materially diminished relatively to the capacity of the cranium. (2.) This increase in absolute weight appears to depend chiefly on an increase in the weight of the *cerebellum* compared with the *pons Varolii*, the *medulla oblongata*, and the *cerebrum*. The general result is, that the *cerebellum* in the insane is heavier in relation to the *cerebrum* than it is in the sane. (3.) Dr. Boyd records the singular fact that almost invariably the weight of the left cerebral hemisphere exceeds that of the right by at least the eighth of an ounce, (Royal Society, Feb. 28, 1861; also, *Med.-Chir. Trans.*, vol. xxxix.) (4.) On arranging the weight of the brain according to the form of Insanity under which the patients laboured, the following average results were obtained:—

Average Weight of the Encephalon.

In *Mania*,	54 ounces	$11\frac{1}{3}$	drachms.
In *Monomania*,	51 ,,	$11\frac{3}{7}$	,,
In *Dementia*,	50 ,,	$5\frac{4}{10}$	,,
In *General Paralysis*,	49 ,,	$12\frac{8}{29}$	,,

The absolute weight, therefore, is greatest in *mania*, and least in the *general paralysis of the insane;* while also the cerebellum

decreases similarly in weight through the same series, with the exception, that in the *general paralysis* of the insane it presents the highest average. Generally it appears that in cases of *acute mania* (which is a form of Insanity generally of comparatively short duration) there is the smallest amount of increase in the relative weight of the cerebellum; while in *general paralysis*—a disease of more prolonged duration—the greatest increase takes place. (5.) The results of observations in the specific gravity both of the grey and white matters of the brain show an increase in the *insane* compared with the same textures in the *sane* (SANKEY, SKAE). (6.) It is consistent also with the records of these observers that the *mode of death* has an influence upon the specific gravity; and, generally, it may be stated that when cerebral symptoms are well marked, such as by convulsions, strabismus, and the like, and when the case terminates by *coma* or by *apnœa*, the specific gravity is higher than when the symptoms are associated with exhausting disease, such as phthisis, and when the case terminates fatally by *anæmia* or *asthenia*. The high specific gravity of the grey and white matter in the former class of cases averaged 1·041, while the average specific gravity of the whole brain in similar cases, as observed by Dr. Bucknill, varied from 1·040 to 1·052; the average specific gravity of the whole healthy brain being only 1·036. (7.) Dr. Bucknill's more recent observations show the most essential change to consist in shrinking of the substance of the brain, with degeneration of the nerve-cells, or a relative atrophy of its substance by a deposit of inert matter (*Med.-Chir. Review*, Jan., 1855). (8.) On comparing the specific gravity of the grey substance in the different forms of mental disease, the lowest appears to occur in cases of *dementia*, where, however, it is 0·003 above the average in the *sane*. The next highest specific gravity occurs in cases of *melancholia*, the next in *general paralysis*, the next in *mania*, and the highest in *epilepsy*. In some of these, however, and probably in all, the *mode of death* appears to influence the specific gravity. For instance, in the *paralysis of the insane* terminating by *coma* or *apnœa*, the specific gravity of the whole brain has been 1·040; while in similar cases terminating by *syncope* or *asthenia*, the specific gravity of the whole brain has not exceeded the average, nor gone beyond 1·039. The average specific gravity of the white substance is lowest in cases of *mania*, next in *dementia*, higher in *general paralysis*, higher

still in *monomania*, and highest in *epilepsy* (*Edin. Monthly Jour. of Med. Science*, October, 1854).

The general results of the more crude examinations of the cranium and its contents in cases of Insanity, in this and other countries, show that, in a very large proportion of cases, there are found some degree of thickening and opacity of the arachnoid, serous effusions into the subarachnoid tissue, into the arachnoid sac and ventricles of the brain, or of serum with lymph more or less gelatiniform, accompanied sometimes with increased, sometimes with diminished vascularity of the brain and its membranes, thickening and adhesion of *dura mater*, gritty state of the *pia mater*, turgescence of cerebral vessels, or of *puncta vasculosa*. Lesions are also more frequently found at the anterior and superior portions than at the base of the brain. Some cases prove fatal by a series of apoplectic seizures when the blood-vessels are extremely atheromatous. In that specific form of paralysis supposed to be peculiar to the insane there also appears to exist a peculiar softening of the grey matter, not indicated by any change appreciable to the eye, but by layers of the grey matter stripping off easily with the membranes, to which it often adheres; by the readiness with which the grey matter is broken up by a stream of water; and by changes in the contents of the brain-cells, as observed microscopically. The morbid state of the brain in the insane may extend to a considerable depth into the grey matter composing the hemispherical ganglia; but the whole of these ganglia are generally more or less implicated, in conjunction with the tubular fibres passing from the hemispheres through the vesicular neurine. Dr. Lindsay has noticed œdematous softening of the central parts of the brain in certain of the cases he has examined. Such changes are generally associated with great vital and nervous depression. In a valuable paper "On the Blood in the Insane," Dr. Lindsay has shown that although the blood is in some cases characterized by particular morbid states, such states are nevertheless not peculiar to insanity. He is of opinion that, save in extreme and exceptional cases, there are no specific abnormalities of the *urine, blood, post-mortem appearances, craniological measurements*, or of *facial characteristics* in the *insane* as compared with the *sane*. With regard to the urine, the same industrious observer remarks, that his results differ widely from those published by Dr. Sutherland and other eminent

authorities, especially as regards the view concerning the elimination of *phosphates*, and the connection of such elimination with Insanity (*Journal of Psychological Medicine*, July, 1856, p. 488). The general result of his experience is that there is virtually no special or distinctive Pathology of Insanity.

It is necessary to bear in view that crude morbid appearances occurring in the Insane are also found more or less frequently in the brains of persons who have died of other diseases, and without any manifestations of mental impairment of the nature of insanity.

Causes.—In modern times Insanity is a disease unhappily of frequent occurrence, and it has been supposed to be extending in proportion to the degree of civilization. It does certainly appear, from an interesting paper by Dr. Winslow in *The Journal of Psychological Medicine* for July, 1857, that diseases of the brain and nervous system are not only of more frequent occurrence, but that a certain unfavourable type of cerebral disorganization tends to develop itself in the present day. This type of cerebral disorder may be characterized as being—(1.) Insidious in its approach; (2.) Tending to that form of Insanity which frequently terminates by suicide; or (3.) Leads at an early age to softening of the brain, at an age—the prime of life—when the Intellect ought to be in an active and vigorous condition of exercise and of health.

The remote causes of Insanity are of a Moral or Physical nature. Of the patients principally admitted into the different hospitals of France, Italy, and Belgium, about *one-tenth* have their insane state attributed to falls, blows on the head, the abuse of mercury, or other Physical causes not determined. The remainder of the cases have their insane condition ascribed to Moral influences—as religion, having been crossed in love, jealousy, family disputes and family cares, reverses of fortune, wounded pride, disappointed ambition, anger, fright, excess of study, libertinage, and drunkenness. It is sometimes difficult, if it is always desirable, to separate Physical from Moral causes in our speculations on the Etiology of Insanity. The action of Moral influences in producing insanity is so striking that the passing events of the day often impress upon the disease its peculiar characteristic. When magic and witchcraft were believed in, Europe was overrun with persons who supposed themselves possessed by the devil. When the Pope was at Paris, that

singular event caused many religious monomaniacs,—a form of Insanity, says Esquirol, which shortly after disappeared.

The causes of Insanity are of a nature producing in the patient, in the first instance, *emotional* changes only, either by the sudden and violent agitation of the Passions, or by the long-continued influence of circumstances operating more insidiously upon the Mind, and producing an habitual state of abnormal feeling. There is no description of Insanity which, if traced to its source, may not be found either to consist in perverted Emotion, or to emanate from that origin (Bucknill in *Med.-Chir. Review* for January, 1854). Dr. Hood's statistics give the proportions as follows:—*Moral causes*, such as anxiety, grief, uncontrolled Emotions, in 40·8 *per cent.* of the males, and 32·7 *per cent.* among females. *Physical causes*, in 19·8 *per cent.* of males, and 21 *per cent.* of females. The chief of these Physical causes are *old age*, abuse of alcoholic liquors, bodily illness, and the critical period in females.

The principal predisposing causes are *age, sex, hereditary descent*, and *disease*.

Age.—Infancy is nearly exempted from madness, and so also is childhood, except in congenital cases. Esquirol, however, gives the case of a child between five and ten years old whose *monomania* lay in attempting to destroy both her father and mother. Insanity, however, as a general principle, seldom breaks out till after puberty, when the Passions are fully developed. Dr. Thurnam's table shows that the greatest liability to the disease exists at the ages between twenty and thirty; while the statistics of Hanwell make the period from thirty to forty to be the most liable to Insanity.

Sex.—It has been much disputed which sex is the more liable to insanity. Esquirol, from returns obtained from the different insane establishments of London and Paris, considered the numbers to be nearly equal; but Dr. Thurnam's tables show that males are more liable than females to attacks of Insanity, in the proportion of 53 *per cent.* of males to 46 *per cent.* of females. An approximation as to the influence of social position on the patients shows a larger proportion of Insanity among the unmarried than among the married population, in proportion to their respective numbers.

Hereditary Origin.—The testimony of almost universal expe-

rience establishes the fact of a very general hereditary transmission of Insanity, varying from 26 to 69 *per cent.* of the cases. This is remarkably instanced among the high nobility of France and other countries, who almost in every instance intermarry, and are allied by blood to each other, inculcating a sad lesson to those parents who consult, in the marriage of their children, their present interest rather than the health of their descendants. This hereditary tendency to Insanity in the aristocracy is greatly insisted on by Esquirol, who states that only one-third of pauper female lunatics were ascertained to belong to families in which Insanity had previously existed; while more than one-half of the female lunatics of the higher classes were thus connected. In general, children born before the Insanity of their parents are less liable to this disease than those born after the attack; also, children born of parents diseased in one line are less liable to it than parents diseased in both lines of descent. The condition of the mother during gestation has often a striking effect on the mental health of her future offspring. Esquirol observed that during the French Revolution many pregnant ladies, whose minds were kept constantly in a state of alarm and anxiety during that period, brought forth children who, in their infancy, were subject to convulsive or other nervous diseases; and in their youth either to *mania* or *dementia*. The form of Insanity chiefly transmitted appears to be *dementia;* the mother's Insanity being chiefly transmitted to daughters, and that of the fathers to sons. Legislative enactments regarding the intermarriage of persons tainted by Insanity are greatly to be desired; and certainly the concealment of Insanity, with a view to marriage, ought to render marriages null and void which are concluded under such circumstances.

Disease.—Certain diseases, also, are powerful predisposing, or even exciting causes of Insanity, such as *epilepsy*, which gives rise to a large number of the most incurable cases. Derangement of function or structure of the uterus is another powerful predisposing cause; and many persons become deranged after severe fevers or attacks of "*sunstroke*," in climates like that of India. Dyspepsia is also a frequent forerunner of Insanity.

Symptoms and Forms of Insanity.—No unobjectionable classification of the forms of Insanity can be propounded; and, as Dr. Daniel H. Tuke justly states, any classification must be regarded

merely as a chart by which we may shape our course, having only the prominent points marked or partially delineated upon it. So far, also, as cause can be ascertained, the same cause does not always produce the same result; for in different individuals it will occasionally produce very opposite forms of Insanity. Dr. Lindsay justly observes, as a result of his prolonged experience, that "a very large proportion—perhaps a majority—of hospital cases of Insanity cannot be referred *simpliciter* to the heading of any *nosology*. Changes of type in the disease are also not uncommon; such that a woman, for example, previously suffering from *melancholia* may become *erotomaniac* or *maniacal: dementia* is a frequent sequel of all the other forms of Insanity. Such changes of type are of constant occurrence; and it is by no means unusual to find the same case of Insanity, at different stages of its progress, presenting the characters successively of *mania*, *monomania*, *melancholia*, and *dementia*. The differences, therefore, between *forms* of Insanity cannot therefore be regarded as *essentially* very great.

The following is the classification (a modification of Heinroth's) suggested by Dr. D. H. Tuke in his and Dr. Bucknill's *Manual of Psychological Medicine*, first edition, p. 89*:—

* I am indebted to Dr. Lindsay for the following synopsis:—

"The following synopsis of the dominant symptoms, principal phases, or general conditions of mental aberration may be considered sufficient for the purposes of the Student, as being at once comprehensive and general, accurate (so far as it goes) and practical. It makes, however, no pretence to rigid philosophical or scientific exactitude, or to exhaustive completeness—an exactitude and completeness which its author believes to be unattainable. But it may claim to be more simple and less technical, and hence more *likely to be easily remembered*, than the majority of the many and varied classifications or Nosologies of Insanity that have been offered during the last half century:—

I. Insanity may be—
  a. *General* [Examples, Mania, Dementia]; or
  b. *Partial* [Example, Monomania].

It may—*apparently*, though perhaps not *really*—affect
  a. *All* the faculties or powers of the mind [Examples, Mania, Dementia];
  b. Or any *one* or *two* of their groups, viz.:—
    1. Intellect proper [Example, Delusional Insanity];
    2. Moral sentiments [Example, Moral Insanity];
    3. Propensities or passions [Examples, Dipsomania, Kleptomania, Erotomania.

II. It may be—
  a. *Congenital* [Example, Idiocy]; or
  b. *Acquired* [subsequent to birth and generally to puberty].

CLASSIFICATION OF DISORDERS OF THE MIND, INVOLVING—

CLASS I.—*The Intellect.*

		FORMS OR PHASES OF INSANITY.
Order 1.	Development incomplete.	IDIOCY. IMBECILITY.
Order 2.	Invasion of Disease after development.	DEMENTIA. MONOMANIA (Intellectual). INCLUDING Delusions. Illusions. Hallucinations.

III. Its characteristic may be—
- *a. Excitement* [Example, Acute Mania];
- *b. Depression* [Example, Melancholia];
- *c. Neither*—No departure from normal character or conduct [Examples, Some cases of Delusional Insanity and Moral].

IV. It may or may not be accompanied by *Delusions*, which may be either—
- *a. Partial and uniform* comparatively [Example, Monomania]; or
- *b. Numerous and variable* [Examples, Some cases of Delusional Insanity].

V. The following *Propensities* or tendencies may be exhibited—any one or combination of them :—
- *a. Destructiveness*—
  1. *To life*—Suicide, homicide;
  2. *To property*—Clothing, furniture, glass, &c. [Example, Pyromania];
- *b. Alcoholic intoxication* [Example, Dipsomania];
- *c. Theft* [Example, Kleptomania];
- *d. Sexual aberration* [Example, Erotomania];
- *e.* Abstinence from food.

VI. It may be—
- *a. Simple;* or
- *b. Complicated* [with other diseases].

The chief complications are—
1. *Epilepsy;*
2. *Paralysis*, which may be—
   - *a. Partial;* or
   - *b. General* [Example, General Paralysis or Paresis];
3. Various—
   - *a.* Functional; or
   - *b. Organic* affections of the—
     1. *Lungs* [Example, Phthisis];
     2. *Stomach* and intestines [Example, Dyspepsia];
     3. *Uterus*, &c.

VII. Each of the main forms of Insanity—
- *a.* Mania,
- *b.* Melancholia,
- *c.* Dementia,
- *d.* Amentia—

may be developed in *different degrees of intensity* [Example, Dementia is represented by mere facility of character—by silliness, imbecility, or weak-mindedness of every grade, onwards to utter fatuity].

CLASSIFICATION OF DISORDERS OF THE MIND—*continued.*

CLASS II.—*The Moral Sentiments.*

	FORMS OF INSANITY.
Order 1. Development incomplete.	MORAL IDIOCY (?). MORAL IMBECILITY.
Order 2. Invasion of Disease after development.	MORAL INSANITY. MELANCHOLIA— 1. Religious. 2. Hypochondriacal. 3. Nostalgic. EXALTATION, regarding 1. Religion. 2. Pride. 3. Vanity. 4. Ambition.

CLASS III.—*The Propensities.*

Order 1. General.	MANIA (usually a disorder of all the faculties).
Order 2. Partial.	HOMICIDAL MANIA. SUICIDAL MANIA. KLEPTOMANIA. EROTOMANIA. PYROMANIA. DIPSOMANIA.

1. **Idiocy.**—*An abortive condition of the intellect from defective development of the brain.* Subjective *phenomena are not capable of being exhibited, and therefore cannot be inquired into. The condition is congenital* (ESQUIROL, COKE, PRICHARD, BUCKNILL, TUKE).

The characters of the idiot, as portrayed by Dr. Tuke, vary according to the degree in which the cerebro-spinal system is involved. In the lower or most abject forms of idiocy the functions of *organic* or *vegetative* life are ill performed; nutrition is most imperfect; the power of reproduction is small; and the patient would perish were it not for the assistance of others. The functions of animal life are likewise impaired, and he may be scarcely alive to external impressions, or possess the power of executing spontaneous acts. In the most abject state of idiocy he is blind, deaf, and dumb, while the excretions are passed involuntarily (*op. cit.*, p. 95). From this abject state there are grades of Intellectual and Moral capacity among idiots; and generally it

may be stated that the greater the organic deformities the more marked will be the imperfections of Sensibility and Intelligence, and the smallest heads appertain to the most degraded class of idiots; but a small head is not a necessary accompaniment of the condition. On the contrary, many idiots have large heads. The abject condition of the idiot is obvious in his vacant stare, in the thick everted lips, the slavering mouth, the irregular teeth, the gums often swollen, the frequent strabismus, the general want of symmetry, the absence or defect of the senses of sight, hearing, and speech, taste and smell. Notwithstanding the staggering gait, he is constantly moving, if on his feet; and, if seated, he has a difficulty in balancing himself, (TUKE, *loc. cit.*)

2. **Cretinism.** — This condition, which is endemic in many countries, and is occasionally sporadic, has been already noticed under the subject of "Goitre" (vol. i., p. 854). Although it seems that some cases are congenital, yet Dr. Tuke, from personal observation, and from the Report of the "Sardinian Commission," believes (*op. cit.*, p. 104) that there is no pathognomonic sign by which cretinism can be recognized at birth; but that a certain combination of symptoms permits the prognosis in childhood of the future development of cretinism. After the fifth or sixth month he describes the infant cretin as presenting the following symptoms:—"The development of the body proceeds very slowly; the child, though weak, is remarkably stout, and appears swollen; the colour of the skin is somewhat dusky, sometimes yellow, sometimes natural; the head is large, the *fontanelles* widely separated, and sometimes all the sutures disjointed. The expression is stupid; the appetite is voracious; and much time is passed in sleep. The belly is swollen; the extremities are generally attenuated; the neck is thick, but not always goitrous; teething is not completed for many years, is generally accompanied by an offensive salivation, and frequently by convulsions. Usually the child cannot stand before its sixth or seventh year; and it is then that it begins to articulate certain sounds, supposing it has not been deaf from birth. The voice is hoarse and shrill, and words are spoken with difficulty." His stature is diminutive. His head is of great size, but flattened at the top, and spread out laterally; and the dissections of Virchow show that the parts at the base of the cranium are early ossified in the form of a rectangle. Early

union of the bones takes place, and with such early union arrest of growth occurs at that part of the skull, while various compensatory developments continue in other parts. Hence the *prognathous* face, and the sinking of the root of the nasal bone. Irregular and partial union of the sutures at an early age is a frequent morbid condition of the Insane, associated with an atrophic condition of the *gyri* below the site of union. The oblique downward direction of the orbit in *cretins* is brought about by the compensating growth of the skull generally, and more especially of the *malar*, the *frontal*, the *temporal* bones, and *zygomatic* arches, in consequence of the deficient development of the *sphenoid* bone. The stunted development of the bones at the base of the skull gives a very short distance between the front and middle part of the cranium; while the diminished growth of the nasal septum and of the jawbones gives a *prognathous* form of face alike to the cretin, the negro, and the monkey. Thus the character of the face in the cretin, as Dr. Tuke observes (*op. cit.*, pp. 105-6), remains unchanged from puberty to old age. The eyes are generally affected with strabismus; the zygomatic arch is large, and the mouth of large size; the lips thick, and the lower one hanging down. The lower jaw is small, retreating, and its angle very obtuse. The predisposition to cretinism appears to be hereditary; and, as noticed by Dr. Watson, it has a close but ill-understood connection with goitre, so that, with few exceptions, cretins are goitrous; and he also observes, that "when both parents are goitrous for two generations in succession, the offspring being in the third generation, are sure to be cretins" (Lect. xliii., vol. i., p. 788). Fodère makes an observation to the same effect.

3. **Imbecility** is synonymous with—

4. **Dementia** is an impaired mental condition, "*a disorder of the intellect characterized by loss or feebleness of the mental faculties.*" The condition is arrived at in several ways, capable of being traced in the mental history of the patient. Some have previously afforded examples of *melancholia*, when they were perfectly conscious, of all that passed around them. Some have been *maniacal*, others have suffered from the severe delirium of fever or sunstroke; but after a partial recovery from these immediate affections, by slow gradations the mental faculties become dulled, confused, and finally obliterated. Others, again, lose their faculties by reason of extreme old age—*senile dementia*—"the last infirmity of noble

minds" (TUKE, *op. cit.*, p. 113). All such cases are remarkable by their conversation and acts, which greatly resemble infancy; and the mental alienation is indicated by the disorder of ideas, affections, and determinations. Feebleness is the essential characteristic of this form of mental disorder; and there is abolition, more or less marked, of all the sensitive, intellectual, and voluntary faculties. On the slightest excitement, some Dements are liable to maniacal outbursts. "If dementia is long continued, its outward signs become well pronounced in the face of the patient. The vacant and puzzled look, the lack-lustre eye, the weak smile, the meaningless laugh, betray the vacuity of Mind" (TUKE, *op. cit.*, p. 115).

Its varieties are *acute and chronic dementia.* Dements may become paralytic, and a thickness of speech may be the first symptom of its approach. After a time the speech is more manifestly affected, followed by a loss of power in the limbs of one side, more marked in the lower extremity, so that the step is feeble and straggling. In the last stage they are completely paralytic, and only able to utter a few unintelligible sounds,—*Paralysis of the Insane*—syn., *General Paralysis.*

5. **Monomania** is a term which comprehends various forms or phases of *delusional* Insanity. There is generally an undue intensity and exaltation of the Conceptive and Perceptive Faculties. The Insanity is more or less partial, in such a way that some one Passion or idea so entirely possesses the patient as to lead often to dangerous conduct. The modes by which the monomaniac gives expression to his particular *delusion* are endless; and the mental affliction is especially indicated by *delusions.* A fixed idea overcomes the Will, and the brain, from its diseased condition, fails to correct the delusions under which the patient labours, by the normal exercise of the Faculties. Reason is unable to dissipate them; the exercise of observation fails to discredit them; and *delusions*, more or less persistent, are the result.

It is hardly possible to understand the nature of this phase of Insanity without being well aware that every sense is liable to express, by the mode in which it performs its function, the existence of cerebral disease; as when light things feel heavy, small things seem large, hot things feel cold; or when the senses are liable, from the irritation of the brain or other cause, to become morbidly *active*, the patient seeing persons or hearing discourses when no such person is present, and no such discourse is related.

Much objection has been taken to the term "*delusion;*" yet the "symptoms of delusion are still accepted in our courts of justice as the most authentic mark of insanity, and as the essence of cerebro-mental disease." The term may be thus defined, from the gist of the writings of Drs. Bucknill and Tuke:—*A delusion is a belief in the existence of things which have no existence in reality, or an erroneous perception of the nature of things, or of their relation to each other, occasioned by cerebro-mental disease;* or again (as Dr. Bucknill defines it), *An intellectual error caused by the pathological condition of the mind, and displaying itself in false Sensation, Perception, or Conception* (*op. cit.*, 317). A few instances of such morbid sensations, perceptions, or conceptions, are the following:—

Dr. Falconer mentions a case in which cold bodies felt intensely hot to the patient, who could not move without believing he was burnt. Esquirol mentions a lady who, being recommended a lavement, was desirous of administering it herself. No sooner, however, was the syringe put in her hands than she threw it away with an expression of horror, stating that it felt so heavy that she believed it to be filled with mercury, and that they wanted to make a barometer of her body. A gentleman whose Mind was in every other respect perfect had constantly the sensation of his mouth being full of pieces of broken glass: while another, curious in his table and choice in his wines, believed everything tasted of oatmeal porridge. The sight is often the medium of morbid perception. Dr. O'Connor met with a patient recovering from measles, to whom every object appeared diminished to the smallest possible size. Baron Larrey mentions a person who saw men as big as giants; and another patient, on recovering from typhus fever, who felt himself to be ten feet high, his bed eight feet from the floor, and the opening of the chimney as large as the arch of a bridge. The celebrated Pascal always believed he saw a precipice on his left hand, and had a chair placed on that side to prevent his falling into it. The ear, also, is likewise often affected. It hears "the airy tongues that syllable men's names." A gentleman riding by a barracks at evening-call never got the sound of the bugle out of his ears for nine months; and everybody knows that Dr. Johnson always entertained a deep impression that, while opening the door of his college chambers, he heard the voice of his mother, then many miles distant, calling him by his name, "Sam! Sam!"

It is remarkable, also, that *hallucinations* sometimes occur when the organ is itself destroyed through which they would be *objectively* expressed, thus showing their *subjective* nature. Esquirol, for example, attended an insane merchant, who, though labouring under *gutta serena*, not only heard persons talking to him, but saw visions that perfectly enchanted him. He had also under his care a Jewess who was blind, and yet saw things the most strange. She died, and the optic nerve, from its commissure to its entrance into the sclerotic of the eyeball, was found atrophied, so that the transmission of any objective impression was impossible. He mentions also two other women absolutely deaf, who had no other delusion than that of hearing every night invisible persons addressing them. Such are instances of *hallucinations*, and the images thus excited are described to be as vivid as those produced by objective causes; so that the patient, when insane, entirely believes the empty and false forms he sees, the ideal sounds he hears, to be real and substantial. Nothing can persuade him of the non-reality of any one of them. Like Macbeth, he insists, "If I stand here, I saw him." It is only by the occurrence of a temporary *hallucination* that we can explain the apparition of the ghost of Cæsar to Brutus, promising to meet him at Philippi; or of the familiar spirit which conversed with Tasso; or of the demon of Socrates, and such like.

In Insanity, if a part of the body be diseased, the Imagination often personifies the disease into some strange reality. There are constantly patients in hospitals for the insane who, suffering pains in the crown of the head, believe they are caused by worms gnawing the brain; or, suffering pains in the stomach, believe that organ to be filled with serpents, frogs, or mice. A woman, for many years a patient at Salpêtrière, who suffered severely from abdominal pains, believed she had a whole regiment of soldiers in her abdomen, and when the pains were severe, that they fought with each other. Another woman, called by the patients "Mere de l'Eglise," believed she had in her entrails all the personages of the New Testament, and occasionally those of the whole Bible. At other times she believed the Popes held their councils in her abdomen. She died, and the abdominal viscera were found adherent to each other and to the peritoneum.

Individual instances of monomania might be classified under *chronic mania* or *melancholia*, according to their character.

6. **Moral Idiocy,** or congenital defect of the Moral sense, while the Intellectual Powers are not deficient, but sometimes superior, is a morbid condition not easily established. There are cases, however, which now and then, throughout the periods of childhood, boyhood, and youth exhibit all the evidence one can have of an inert Moral nature, associated with an activity of the animal Propensities. Over such a mental condition threats, rewards, or punishments exercise little or no control. There is said to have been at one time in the Richmond Lunatic Asylum, in Dublin, a man who exhibited a total want of Moral feeling and principle, but who possessed considerable intelligence, ingenuity, and plausibility. Dr. Crawford wrote of him that he had never been different; that he had never evinced the slightest mental incoherence on any one point, nor any kind of delusion. He appeared, however, so totally callous with regard to every Moral principle and feeling; so thoroughly unconscious of ever having done anything wrong; so completely destitute of all sense of shame or remorse, when reproved for vices or crimes; and he proved himself so utterly incorrigible throughout life, that Dr. Crawford expresses himself as almost certain that any jury before whom he might be brought would satisfy their doubts by returning him insane. The "exact counterpart" of this case was admitted into the New York State Asylum (Benedicts' *Annual Report*, 1850). Dr. Tuke gives many other instances besides these (*op. cit.*, p. 181); but it is still very doubtful if *Moral Idiocy* can be recognized as apart from impaired Intellect; although feeble Moral Powers and Volition, or dangerous peculiarities of temper, may be occasionally associated with good intellectual abilities.

7. **Moral Insanity as Developed in Adult Life.**—A standard of *mental health* is to be sought for in the natural and habitual character of the patient; who being thus compared with himself, it will be seen that a change in his feelings and conduct sets in gradually. Moral Insanity has been more or less clearly defined by Drs. Prichard, Tuke, and Bucknill. Dr. Tuke observes that the adult about to become insane in this respect is "more absorbed or reserved, and on any provocation, however slight, is unreasonably irritated. He becomes suspicious, liable to attribute false motives to his friends or to others, and to cast ungenerous reflections upon his nearest relatives." He is ob-

served to be morose. The alteration of the man from his former nature is complete; and some act of an outrageous character is at last committed. In other cases, an individual has been subjected to over-exertion of mind, his powers overtasked, or his feelings put upon the stretch in consequence of anxiety or unaccustomed responsibility. He then finds himself susceptible to the slightest Emotion. Sleep and rest are lost; he is conscious of more or less uneasiness about the head,—a sense of tension and dull aching pain; and at last he is unequal to the discharge of his usual duties. Certain impulses and tendencies begin to distress his Mind, because he knows they are alike repugnant to his Reason and to the dictates of his Moral nature. Often the impulse is to do violence to himself or others; or it is simply to break glass or articles of furniture (*op. cit.*, pp. 185, 186). The *Moral Insanity* thus expresses itself simply as a tendency to disordered emotional excitement, which affects the course of Thought and action, without destroying the reasoning process in any other way than by supplying wrong materials to it. There may be no disorder of the Intellectual Powers, or any delusion whatever (CARPENTER). *Reason* does not reign supreme: it is simply retained possession of while the *Feelings and Emotions* are beyond control. Circumstances in life create feelings and prejudices which prevent the morally insane patient from passing through life smoothly. As regards the *Intellect*, the patient is not insane; but he cannot control his Feelings or Emotions.

Among patients morally insane, physical health, as Dr. Tuke observes, is almost as frequently deranged as it is among those whose Intellect is manifestly disordered; and the cases not unfrequently terminate in some unmistakable physical disease, such as general paralysis. In a large number of cases the patient has been, in childhood, or is, subject to epilepsy; and there can be no doubt that convulsions in infancy are, in relation to their ultimate effects on the Mind, not sufficiently recognized. They often pass away and are forgotten, but some portion of the cerebral tissue has doubtless received an injury which, in any other tissue of the body, would be easily recovered from, but which permanently injures the delicate tissue of the brain of the child, so that his Moral or Intellectual Powers are impaired; and the result is painfully perceptible as the child grows up to manhood (*op. cit.*, p. 187).

The diagnosis is to be made between this form of Insanity and mere vicious propensities; and the only ground of diagnosis, as pointed out by Dr. Bucknill, lies in the mode of causation. "Moral insanity is always preceded by an efficient cause of mental disease, and there has always been a notable change in the emotions and the propensities following" (l. c., pp. 328, 329).

8. **Melancholia.**—It is a "*disorder of the intellect with depression, often with suicidal tendency.*" A state of melancholy is often the first indication of Mental disease. It may precede *mania*, and it is associated with or supervenes upon other forms of Insanity. It may supervene suddenly, as when it is the immediate consequence of grief; or it may come on gradually, as the mere exaggeration of a naturally melancholy frame of mind. Sudden melancholia is rare. Premonitory symptoms generally indicate a period of incubation more or less prolonged and sufficiently obvious. A state of depression often follows upon a state of *mental elation*, or on prolonged mental exertion and occupation, which suddenly ceases. It also succeeds the mental exaltation produced by inebriating drinks. These effects, however, are generally slight and transient, and the cases of this kind ought to be separated from those cases in which the depression becomes persistent. In *Persistent melancholia* the "relish for existence" becomes less and less, the spirits become depressed, and the man feels unequal to the ordinary duties which call him into public life. In the domestic circle he becomes silent, and seeks entire solitude (TUKE, *op. cit.*, p. 148).

> "He makes his heart a prey to black despair;
> He eats not, drinks not, sleeps not, has no use
> Of anything but thought; or, if he talks,
> 'Tis to himself." (DRYDEN).

And even although he is "cheerless, moody, and taciturn," as Dr. Tuke observes, "he appears to be unceasingly revolving in his mind his unfortunate condition, which, while he regards it as worse than that of any other person, he still believes to be good enough for a miserable wretch like himself." His Propensities are to indolence and general indifference. He reads nothing, writes to nobody, shuns all exertion. One dominant Propensity alone is too often active, namely, self-destruction (CONOLLY); while obstinate abstinence from food and drink is a common

feature. There is greatly increased susceptibility of the Emotions; and the subjects of *melancholia*, in its early stage, are easily moved to tears by trivial circumstances. All consolation is disregarded by such patients. They are beyond persuasion. Nothing can subdue their Will, convince them of their error, quiet their alarms, or allay their fears. Nothing can remove their prejudices, overcome their repugnances, or conciliate their aversions. Nothing can divert them from the engrossing thoughts that occupy their mental energies, and take possession of their Emotions. Occasional remissions of the affection may deceive the patient's friends for a time; but the disease progresses till the patient is either placed under the care of competent guardians, or he voluntarily seeks the tranquillity of an asylum. But, fortunately for the chances of cure, a love for and appreciation of the ridiculous is often associated with the tendency to *melancholia*. Cowper, who penned "John Gilpin," is a familiar example. Carlini, a French comic actor of reputation, consulted a physician to whom he was unknown, on account of attacks of profound *melancholia* to which he was subject. Amongst other remedies, the doctor recommended the diversion of the Italian Comedy. "Your distemper," said he, "must be rooted indeed if the acting of the *lively Carlini* does not remove it." "Alas!" said the miserable patient, "I am the *very Carlini* whom you recommend me to see; and while I am capable of filling Paris with mirth and laughter, I am myself the dejected victim of melancholy and chagrin" (Prefect's *Annals of Insanity*, p. 404, quoted by Dr. Tuke, *op. cit.* p. 150).

The ultimate course of cases of *melancholia* varies with the constitution of the patient, his age, the degree in which the disorder is complicated, and the existence of hereditary predisposition to mental disease. It tends to pass into *dementia;* but the tendency thereto is much less marked than in *mania*. The prognosis is more favourable in simple *melancholia* than when complicated with disorder of the Intellect.

Among the earliest mental phenomena *are forgetfulness, abstraction, simple depression of spirits, alterations of the Affections towards children or other near and dear relations, restlessness, religious dreads, delusions, alterations of the Instincts, such as hunger.*

"*Among the earliest* physical symptoms *of melancholia are loss of sleep and disturbed dreams. The digestive organs are fre-*

quently deranged, the tongue is unnaturally red or loaded, there is fulness at the epigastrium, and the alvine evacuations are deficient in bile. The tongue is sometimes flabby, pale, indented at the edges; a fixed dull pain, or an ill-defined sense of oppression is often experienced in the head. The pulse is generally slow and compressible. The urine is often pale, sometimes high coloured, depositing lithates. The skin varies: it is usually harsh, but not unfrequently it is moist and clammy. The uterine functions are more or less disordered, and in a large majority of cases are suspended. In men the reproductive instinct is in abeyance" (TUKE, *op. cit.*, pp. 152, 153).

Constipation, long-continued and habitual, associated with solitude and family cares in persons formerly healthy, and of excitable and lively dispositions, appear in some cases to have acted as an exciting cause of *melancholia* (Dr. W. H. O. Sankey, *Med. Times and Gazette*, September 19, 1863).

Melancholia comes next in frequency of occurrence to *mania*. It is frequently hereditary; and all its varieties are disposed to be remittent. "It is generally observed that the remission takes place in the latter part of the day, the patient suffering most acutely in the early morning, and for some hours subsequently." In those cases which have a suicidal tendency this remittent character should be borne in mind (TUKE, *op. cit.*, p. 171).

The principal forms which *melancholia* assumes are—(1.) *Religious;* (2.) *Hypochondriacal;* (3.) *Nostalgic.*

In the *first* form of melancholy the impress is given to its character by the religious tendencies of the patient, the exciting cause being not rarely traceable to the fiery denunciations of well-meaning but injudicious preachers. "There are some preachers whose great power in the pulpit is to be attributed to the excitement and alarm they are able to produce upon susceptible listeners. They delight to suspend such persons over the bottomless pit, in order to drag them up again when they fancy they have sufficiently impressed them with most unchristian terror. Such preachers were wont to be banished in Pagan times by a law of Marcus Aurelius.

In the *second* form, that of *hypochondriasis*, the morbid mental state is expressed by the *exaggeration or increase, to a morbid degree of intensity*, of that property which every one possesses more or less, by virtue of his physiological and psychological

endowments, of creating around him, or within himself, sensations which are not the result of external impressions or corporeal conditions; but which, having their origin in the Mind (subjective), are represented and appreciated by the material organs of the body. It consists essentially in the transference of a phenomenon (subjective or mental in its origin and essence) into what appears to be a real material change, appreciable sometimes by others (REYNOLDS). It is often expressed by the sense of touch, combined with a morbid imagining, so that the patient believes himself to be strangely metamorphosed, changed into some inanimate thing, or he loses all knowledge of his personal identity; and this form of disease is sometimes combined with other *delusions*. The odd conceptions of the patients under these circumstances are singular enough. Men have imagined themselves to be so much butter or putty, and in the one case to be unable to bear heat for fear of melting, and in the other have forborne to walk, lest their legs should be crushed by the weight of their body. One man keeps the house, imagining he is too large to pass through a given door-way; and when he is pushed through he screams, and will affirm that his flesh is being torn from his bones. Another imagines he is a pump; that his arm, which is in perpetual motion, is the handle; and bitterly complains that the inhabitants will let him have no rest, morning, noon, or night. A third goes round to his neighbours, believing that he is a ~~seven~~ two-shilling piece, and hopes, if his wife should bring him to their shops, they will neither take him in payment nor give change for him. A fourth supposes himself transformed into a beer-barrel rolled along the streets. A fifth, that he is a mutton-chop, and insists that he shall be taken daily to the butcher to be trimmed. Bishop Warburton speaks of a person who thought himself a goose-pie, a circumstance referred to by Pope in his sketch of hypochondriasis,—

> "A pipkin there, like Homer's tripod, walks;
> Here sighs a jar, and there a goose-pie talks."

Among other singular forms of *hypochondriacal Insanity* is a belief in an absolute change of sex. Dr. Arnold saw a man who fancied himself in the "family way;" and Esquirol speaks of a male patient who fancied himself a woman, and felt insulted if the slightest liberty was taken with his dress. Some have thought

themselves converted, like Nebuchadnezzar, into wild beasts. Some patients imagine they have no soul, others no body, others that they are absolutely dead. One gentleman, approaching his ninetieth year, so far lost his mind that he assembled his family around him, and announced to them that he was dead; begged, in communicating the sad intelligence to his absent friends, they would say he went off easily, and expressed himself a little scandalized that the windows were not closed on the occasion, and entreated, as a last favour, for one pinch more out of his favourite snuff-box before he was finally screwed down. A soldier, who received a severe wound at the battle of Austerlitz, believed he had died, and that the body he had now got was not his own. Another, that he was guillotined during the French Revolution, and had not only lost his own head, but, somehow or other, had got a new one. A third, that his head had been put on his shoulders with the face towards his back; and, lastly, some believe they have not only lost their heads, but can see them rolling on the ground.

It is seldom, however, that *hypochondriasis* is of so simple and harmless a nature. More commonly the Affections are subverted, and those who ought to be most dear to the patient by the ties of relationship become most hateful. The mind, too, is more commonly swayed by some destructive Passion to effect some object criminal in itself. *Delusions* are neither necessary nor essential symptoms. *Hypochondriasis* is often one of the worst concomitants or sequelæ of dyspepsia (WATSON).

Third, The *nostalgic* form of *melancholia* (sometimes expressed by the term *nostalgia*) makes itself obvious by an inordinate desire to return to one's native country when far away from home, and to which is added the apprehension, on the part of the patient, that he may never be able to return. The prophecy of the inspired writer seems ever ringing in his ears, when he wrote —"Weep ye not for the dead, neither bemoan him; but weep sore for him who goeth away: for he shall return no more, nor see his native country" (Jeremiah, chap. xxii., ver. 10). Army surgeons often witness such cases of home-sickness. Ninety-seven soldiers in the French army fell a sacrifice to this disease between 1820-26; and the celebrated Baron Larrey came to the conclusion that the mental faculties in nostalgic patients were the first to undergo a change. Decided aberration of Mind was

present in all the cases which he has recorded, expressed by exaltation of Imagination, especially in extravagant delusions respecting their homes. This mental excitement was accompanied by increased heat of the head and acceleration of the pulse. There was redness of the conjunctivæ, and unusual movements of the patient were frequently observed. Uncertain pains occurred in various parts of the body. The bowels were constipated. There was a general feeling of oppression and weariness; an inability to fix the attention; and conversation was apt to be unconnected. A sense of weight and pain pervaded the viscera. There was also sometimes partial paralysis of the stomach and diaphragm, and symptoms of *gastritis* or *gastro-enteritis* would supervene. Under these circumstances prostration of strength ultimately becomes extreme, mental depression keeps pace with the decline of the body, the patient lies weeping, sighing, or groaning, and a propensity to suicide is not unfrequent when the debility becomes extreme. General paralysis is common; but death is the result of a gradual exhaustion of the vital powers (TUKE, *op. cit.*, p. 156).

The Dutch, the Swiss troops, the Highlanders, and the Irish, are those soldiers amongst whom this form of insanity has been mostly noticed, and the disorder is apt to be prevalent during extreme height of the barometer.

9. **Mania,** having its origin in disordered Emotions, is essentially a disorder of the Impulses or Propensities in the first instance, tending to more or less "*disorder of the Intellect with excitement.*" One or more of the Passions is almost always exalted in *mania,* of which there are two forms—namely, *acute mania* and *chronic mania;* and furious expressions of passion, of prolonged duration, are very generally present in the acute form of this disease. It has in almost all instances its stages of incubation. At first there may be only apparently trifling irregularities in the Affections. The maniac may be at the outset of his disease either sad or gay, active or indolent, indifferent or eager, but he soon becomes impatient and irritable (ESQUIROL). He neglects his family, forsakes his business and household affairs, deserts his home, and yields himself to acts which strikingly contrast with his ordinary mode of life. Delirium and Reason begin to alternate with each other. Periods of composure and agitation succeed each other, and so do acts the most strange and extravagant.

The kindest love and tenderness of domestic life serve but to irritate and provoke, so that to remain in the bosom of his family excites the patient by slow degrees to the highest pitch of fury.

It is seldom in *mania* that the patient, as in *monomania,* is only insane on one subject. His mind, says Esquirol, is a perfect chaos; all is violence, effort, perturbation, and disorder. He confounds time and space, associates persons and things the most unnatural, creates images the most unreal, and lives isolated in feelings and reasoning from all the rest of the world. He hates all whom he was wont to love, and wishes to overthrow and to destroy everything. The female maniac, perhaps in health the model of candour and virtue, gentle and modest, an affectionate daughter, a devoted wife, and a good mother, becomes in this disease bold and furious, exposes her person unmoved to the gaze of every eye, is blasphemous and obscene, respects no law either of decency or humanity, and threatens her father, strikes her husband, or perhaps murders her children.

In another class of cases the premonitory symptoms are characterized by gloom and despondency, upon which the maniacal excitement supervenes. There is generally a marked departure from the patient's former state of health. *Insomnia* is one of the most important and earliest symptoms. The functions of the body are more or less deranged, and fever may prevail, sometimes severe.

Special forms of mania may be noticed under the following heads:—

(*a.*) **Homicidal Mania** in some cases is the result apparently of delusions, of suspicion, or of implacable enmities against supposed foes. A plausible reason is generally assigned for the attempt in such cases; the victim is represented as having systematically annoyed, or irritated, or conspired against the lunatic. In other cases the attacks are the offspring of momentary, uncontrollable impulse, without cause *quoad* the persons assaulted. The pretext for assault is then frivolous in the extreme—*e. g.*, "he could not help it," or he did it "for fun." Such homicidal impulse and attempts of the most persistent and dangerous kind may co-exist with a perfect knowledge of right and wrong, and their bearings on human actions—with perfect ability also to manage business affairs, though of a complex pecuniary character—with

perfect propriety in maintaining most of the relationships, or of discharging most of the social or public duties of life—with deportment often the most polished and gentlemanly, the most considerate and kind (Dr. Lindsay, *Rep.* xxxvii., p. 42). Gall gives the case of a man at Vienna who, after witnessing a public execution, was seized with an uncontrollable propensity to kill, although he had a clear consciousness of his situation, expressed the greatest aversion to commit such a crime, shook his head, wrung his hands, and cried out to his friends to keep away. Pinel mentions the case of a person who exhibited no other unsoundness of mind than this propensity to murder; so that his wife, notwithstanding his tenderness for her, was nearly being destroyed, he having only time to warn her to flee. In the intervals of the paroxysm he expressed the greatest remorse, was disgusted with life, and attempted several times to put an end to his own existence. Esquirol mentions a woman seized with sudden paroxysmal impulses to destroy her children, and only saved them by locking the bed-room door and throwing the key away. Metzyer relates a similar case of a nurse who requested to be discharged, giving as a reason that every time she undressed the child, struck by the whiteness of its skin, she had an irresistible desire to rip open its belly. The deadly purpose is accomplished in many different manners and times. Sometimes the murder is long premeditated and the victim marked out, the patient concealing a knife about his person till an opportunity for effecting his object presents itself, though that period be remote. In other cases the destructive propensity seems the result of a sudden impulse. Esquirol mentions the case of a patient who was sitting by the fire with other patients, when he suddenly seized a chamber-pot and broke it over his neighbour's head: fortunately, he was immediately secured. In a lucid interval he stated that he had made this homicidal attempt in consequence of his brother having appeared to him at that moment, crying out, "Kill him! kill him!" Others, again, are so aware of the approach of the attack that they entreat to be confined, in order that they may not commit the mischief to which they seem irresistibly impelled.

(*b.*) **In Suicidal Mania** there is an irresistible propensity on the part of the patients to destroy themselves. Some of these unfortunate persons, not having resolution to put themselves to

death, have killed others, in order to suffer a judicial death. One woman reasoned, "In order that I may die I must kill some one," and accordingly she attempted to kill both her mother and her children. Some of these tragedies are most terrific. A man in a paroxysm of Insanity is related to have killed his wife and three children, and would have killed the fourth had it not escaped. After these horrible sacrifices he ripped open his own belly; but the wound not being mortal, he again drew out the instrument, and pierced himself through and through. This man had enjoyed a good education, and was of a mild disposition. In a large number of the cases the suicidal propensity is developed in connection with *religious melancholia*—a form most difficult to eradicate or conquer; and, from its inveteracy, the forerunner often of incurable Insanity.

The propensity to commit suicide is in some persons so great that many destroy themselves although in possession of fortune, of station, of objects of affection, and apparently in every other respect in the fullest enjoyment of happiness. The ingenuity of the patient in providing means for his own destruction is often singular. Some have thrown themselves under the wheels of a waggon; and recently it has not been uncommon for them to cast themselves before the locomotive of a railway train in full speed; others have drowned themselves in an incredibly small quantity of water; others have most ingeniously strangled themselves; and others, more closely watched, have swallowed all sorts of heterogeneous articles—pins, needles, bits of broken glass, nails, buckles—in short, any and every hard substance they could force down their throats. Pinel gives the case of a man who had cut off one of his hands with a hatchet before his arrival at Bicêtre, and afterwards, in spite of his bonds, attempted to tear the flesh off his thigh with his teeth.

(*c.*) **Pyromania.**—The derangements of the Emotions and of Reason may take other forms than murder; and arson is one of the more common. Some seem impelled to this criminal act by the mere sensual gratification of the excitement, confusion, noise, and bustle consequent on the conflagration; delight in the blaze, the ringing of the bells, and in the thronging of the people. It may also result from a process of reasoning, or from acting upon some delusion, as in the destruction of York Cathedral by Martin,

effected under a feeling of Divine impulsion, and of his being commissioned thus to purify the house of the Lord.

(*d.*) **Kleptomania** is an irresistible desire to steal. Gall mentions that the first King of Sweden was always stealing trifles; and a countess at Frankfort had the same propensity. Esquirol gives the case of a lady of an exactly opposite character. Her Insanity consisted in a ceaseless dread of appropriating what did not belong to her; she therefore combed her hair an endless number of times in the day, examined her dress minutely every time she put it on or took it off, felt in her shoes, turned up the chairs, looked under her plate, and thus consumed many hours in the day in endless cares lest something of value might have adhered to her dress.

Such are some of the forms or phases of a malady whose varieties are endless. It may be objected by some to the account here given of Insanity, that whereas book descriptions of the disease generally refer to what are regarded as typical cases, which are selected, exceptional, and extreme, yet in the great bulk of the insane the phenomena or symptoms of the malady may be either so complicated and intermixed, or so obscure and ill-marked, that it is not only impossible but futile to attempt a scientific enumeration or classification of all.

Diagnosis.—There are two especially weighty reasons why it is important to obtain a correct diagnosis—namely, *first*, with reference to the necessity of an early application of remedies; and *second*, with reference to the question as to whether or not the person presumed to be insane is or is not legally responsible for his acts.

Dr. Winslow has shown with what inexcusable neglect affections of the brain are generally treated by the public, and the lamentable amount of ignorance that unhappily exists in the non-professional mind respecting these disorders,—a neglect and ignorance which, by sins of omission, often suffer the sacrifice of valuable human life to occur. The overwrought brain meets with but little attention and consideration when in a state of incipient disorder. While medical advice and remedies are eagerly sought for trivial organic or functional disorder in other parts of the body, serious well-marked symptoms of brain disorder are often entirely overlooked and neglected. Such symptoms are not unfrequently permitted to exist for months without

causing the faintest shadow of uneasiness or apprehension in the mind of the patient or his friends. These premonitory indications of cerebral mischief, or *prodromata*, as they are technically called, consist of *morbid alterations of temper, depression of spirits, amounting sometimes to melancholia; headache, severe giddiness, inaptitude for business, loss of Memory, confusion of Mind, defective power of mental concentration, the feeling of brain lassitude and fatigue, excessive* ennui, *a longing for death, a want of interest in pursuits that formerly were a source of gratification and pleasure, restlessness by day and sleeplessness by night.* Any one or more of these symptoms obviously indicate an unhealthy state of the functions of the brain and nervous system; but their insidious mode of approach, and the unwillingness of friends to believe that anything is wrong with their relative, rarely if ever permit the symptoms to attract attention till some phase of insanity becomes unmistakably developed. If a person previously in a state of bodily and mental health is conscious that abnormal changes are taking place in his Mind—that trifles worry and irritate him, that he feels his brain unfit for work, that his spirits flag, that he tends to magnify all the evils of life; if, moreover, he is observed to be fanciful, if he imagines things to exist which have no existence apart from himself, if he believes that kind friends ill-use and slight him; if, besides, symptoms like these, or analogous to these, are associated with headache, derangement of the digestive organs, want of continuous sleep, the friends of such a sufferer may rest assured, and the patient may perhaps be convinced, that the state of his brain is abnormal, and he may be induced to commit his case to the careful consideration of a Physician. Symptoms of severe bodily fatigue, associated with extreme depression of spirits, mental exhaustion, reverie, paroxysms of melancholy, partial somnambulism, or hallucinations manifesting themselves at an early period of life, must be regarded as important psychical phenomena—deviations from the state of health, requiring the most careful and cautious Moral and Intellectual training, combined with medical and hygienic treatment; more especially to be persevered in if despondency become more marked, or if gloomy thoughts and apprehension of an early death lay hold of the Mind. Of the numerous and seemingly increasing cases of suicide which occupy a place in our daily newspapers, in most of

them well-marked symptoms of physical ill-health, disorder of the brain and nervous system, may be traced to exist before the act of self-destruction. In upwards of a hundred recent cases Dr. Winslow has shown this connection to have existed. These cases are full of interest, and demand the most attentive study by the student who would make himself acquainted with the earliest symptoms and most distressing results of Insanity. They are recorded in *The Psychological Journal* for July, 1857, already referred to.

To obtain a correct and early diagnosis, with a view to attain either or both of these objects, one "*only safe rule*" is to be observed; for in the existing state of legal and medical science there is no uniform test of Insanity, either of a legal or of a medical kind, which can be safely or certainly applied. This rule consists in a close and thorough appreciation of the physical and mental aspects of the existing condition of the presumed lunatic, at the period of his supposed Insanity, compared with his prior physical and mental manifestations, which were regarded as his natural and healthy state, and which had not been observed to be different from those of other men—"*a comparison of the individual with his former self.*"

This point was originally insisted on by Dr. Combe; and the necessity of making the Mind of the individual patient, and not that of the Physician, the standard of comparison by which to determine the sanity or insanity of the patient cannot be too strongly urged. The man must be the measure of himself; and this principle is found to be of universal application in all physiological and pathological investigations. For example, before the Physician can judge of the condition of the urine passed by a man in disease, he must know the conditions of that man's urinary excretions when they are in a normal state. Scarcely two men are alike in this or in any other respect regarding their excreta,—age, weight, height, and many other circumstances materially modifying the result.

In judging, therefore, of all cases of presumed Insanity, the Intellect must be considered in relation to itself,—the manifestations of Mind *now* must be compared with those which have been *heretofore* expressed by the same individual; and if mental phenomena are ascertained to exist of a morbid kind, compared with those which have been expressed before, and especially if

there be any symptom of cerebral disease, the individual may be fairly deemed insane, and, if so, legally irresponsible for his acts. Between the criminal and the insane mind there are important relations, and it can be shown—as there is reason to believe valuable evidence and strong testimony exist to prove—that a large amount of crime is connected by hereditary predisposition and descent with minds diseased. A large field of usefulness is here opened to the Politician, the Lawgiver, and the Physician, from which future generations can alone hope to reap the benefits —when crime and lunacy may perhaps diminish together.

The following rules, compiled from Drs. Bucknill and Tuke's admirable work on *Psychological Medicine*, ought to be adhered to in diagnosis:—(1.) *Learn as thoroughly as possible the antecedents and history of the patient.* One of the great difficulties to overcome in the diagnosis of Insanity, especially in the endeavour to ascertain the antecedents of an attack, is the great risk the Physician runs in being misled by the interested statements of friends and relatives. They too frequently act on the principle that "what they wish to be, that they believe." They may wish their relative to be considered sane, or the contrary; and they may believe him to be so when he is not, or the reverse; and they will at first invariably disguise or deny circumstances which might be thought discreditable to the presumed patient or themselves. The Physician will therefore often find himself surrounded by relatives of the patient from whom he can derive little information which is unbiassed and trustworthy. He will find the household divided against itself; and seeing that such is the case, his best policy is to become a good and patient listener; and if he has a good memory, and is quick in perception, he will arrive at conclusions the more readily that he avoids all cross-examination. With prudence and caution he ought then to seek out people who have known the patient, but who are neither friends nor neighbours, whose evidence will often be more truthful and useful to him. One great aim of such inquiry ought to be to ascertain the existence or not of hereditary predisposition, and of previous attacks of Insanity. (2.) *Estimate the value of the hereditary tendency, upon the following principles:*—(*a.*) The Insanity of one parent indicates a less degree of predisposition than that of a parent and an uncle; and still less than that of a parent and a grandparent, or of two parents; (*b.*) The Insanity of

a parent and a grandparent, with an uncle or aunt in the same line, may be held to indicate even stronger predisposition than the Insanity of both parents; (*c.*) The Insanity of a parent occurring after the birth of a child, without predisposition, is of no value in the formation of a hereditary tendency; (*d.*) If several brothers or sisters, older and younger than the patient, have become insane, the fact tells strongly in favour of predisposition, although neither parent nor grandparent may have been so. (*e.*) The Insanity of cousins cannot yet be determined as worth anything in favour of predisposition, except in corroboration of other and weightier facts (BUCKNILL, *op. cit.*, p. 272). (3.) *Ascertain if there has been any change of habits or disposition.* The Physician will thus learn what kind of a man the patient has been when in health. The over-susceptible rather than the eccentric man is the more likely to become insane. (4.) *Exercise the greatest tact and discretion in the personal examination of probably insane patients.* Obtain an introduction to the patient in as natural a way as possible; and above all, avoid commencing any conversation which will tend to divulge the object of the visit. In the incipient stage of disease the patient is generally suspicious and hostile, contrivance and great tact being required to open up a conversation. It may even be necessary for the Physician to be a party to some deception; but he must bear in mind that the discovery of even the slightest deception by the patient may have a most prejudicial influence on future treatment. As a general rule, it is best to engage the attention, and obtain at least the good-will of the patient by sympathizing inquiries respecting bodily ailments, or concerning such things as he knows the patient takes a lively interest in; and the first aim of the Physician must be directed to placing himself on good terms with his patient. "For this no general directions can be given. He must employ that tact, derived from good sense and knowledge of mankind, without which he will find himself lame and impotent in the field of medical practice amongst the insane. The most difficult cases are those in which differences of opinion and of interest exist among the members of the patient's family; and when the patient has quietly been told by some one of the family that it is wished to prove him insane, and to place him under confinement, and that a doctor is coming to examine him for that purpose. The Physician, under such circum-

stances, must then do the best he can; and if this is but indifferently well done, he may content himself with the reflection that the fault is not his" (BUCKNILL, *op. cit.*, p. 279). (5.) *Observe any peculiarities of residence or of dress.* Many circumstances testify to a want of order and direction in household affairs where the head of the family is insane; in the room occupied by the patient things are liable to be out of place, especially as regards the decoration of the walls and the arrangement of the furniture. A love of order is rarely seen among the insane. (6.) *Study the appearance, demeanour, and general conduct of the patient.* (7.) *Notice any peculiarities of bodily condition.* This is necessary, especially as regards plumpness or emaciation, the state of the skin, the pulse, the tongue, and the temperature, as indicating impaired bodily health. (8.) *Observe any peculiarities of gesture,* and the expression of the countenance of the patient. One of the great difficulties of diagnosis, also, is to distinguish cases of *monomania* from *sanity.* With the exception of some given *delusions,* turning on a small number of fixed ideas, the patient may be rational on all other subjects; and in some instances even the powers of his mind may be superior, and they often are so. One celebrated instance of this kind occurred to the late Lord Erskine. The patient had indicted a most affectionate brother, together with the superintendent of the asylum, for false imprisonment. He was placed in the witness-box, and the learned Lord, not instructed in the *delusion* of the monomaniac, consumed the whole day in fruitless attempts to expose it. At length Dr. Sims came into court, and suggested to the learned counsel that the patient believed himself to be the Lord and Saviour of mankind. Lord Erskine then adroitly addressed him in that character, lamenting the indecency of his ignorant examination. The patient at once expressed his forgiveness, and with the utmost gravity and emphasis, in the face of the whole court, said—"I am the Christ." In a similar case, tried before Lord Mansfield, the patient evaded the questions of the court the whole day, till his Physician arriving, asked him what had become of the princess with whom he corresponded in cherry-juice. Instantly the man forgot himself, and said it was true he had been confined in a castle, where, for want of pen and ink, he had written his letters in cherry-juice, and thrown them into the stream below, and that the

princess had received them in a boat. Such answers, of course, immediately terminated the cases. (9.) *In medico-legal cases let the Physician avoid becoming a partizan.* He ought never to permit his evidence to be led by counsel on either side on matters of opinion, either directly or indirectly. "Facts observed by himself" are the elements on which alone his reputation can be safe. On all other points let him steadily refuse to give forth the expression of a mere opinion in the witness-box.

The student will also find some valuable "*hints for certifying in cases of lunacy,*" by Dr. J. S. Bushnan, in the *Medical Times and Gazette* for August, 1862.

Prognosis.—As a general rule, the younger the patient the greater are the chances of recovery; but above the age of fifty few are cured. The comparative curability of Insanity in its earlier phases is also fully proven by the records of asylums for the insane; while the advantages of early treatment, and the superiority of hospitals for the management and cure of the insane is now fully shown by the increasing annual admissions to these useful public institutions. Of those that recover, the exciting cause often greatly influences the result. Many cases recover when the Insanity proceeds from drunkenness, provided the patient can be restrained from drinking alcoholic fluids; and also if the Insanity arises from slight moral or physical causes. When, however, the shock is severe, the recovery is less certain, and if combined with epilepsy, recovery is almost impossible. The form of the disease also greatly influences the result. When the patient suffers from *delusions,* the chances of recovery are much diminished. Taking Insanity generally, *monomania* and *dementia* are least frequently cured; *mania* is most frequently cured or improved; and *melancholia* holds an intermediate place. In the Murray Lunatic Asylum, over a period of thirty years, the recoveries from *mania* amounted to 55·02 *per cent.;* from *melancholia,* 31·38 *per cent.; monomania* and *dementia,* 6·90 and 6·70 *per cent.* respectively (*Thirty-Third Report,* p. 11). Thus *mania* is the most, and *dementia* the least hopeful form of Insanity; and the chances of recovery are greater in *melancholia* than in *monomania.* If, when labouring under Insanity, the patient be seized with palsy, it is rare that he survives beyond a twelve-month after the first symptom—the affection of the speech. The patient may even appear comparatively strong, but great excite-

ment may be followed suddenly by collapse, and a fatal issue supervene sooner than inexperienced persons would anticipate.

In both sexes the recoveries average 51·5 *per cent.* when the cause of the Insanity is of a moral character, and 33·8 *per cent.* when the cause of the disease is of physical origin; and the recoveries are only at the rate of 14·6 *per cent.* when the only cause that can be assigned is hereditary predisposition. The influence of sex on recovery is peculiar. In males the disease terminates at a much earlier period than in females, and its *early* termination in the male is more frequently caused by death. The cases of Insanity in the male sex are not therefore to be considered as more curable, but rather as more fatal; and in the female, also, the cases cannot be said comparatively to be more curable, for although they may not die so readily as the males, the disease may continue in them, passing into a chronic and more permanent state (Hood's *Statistics of Insanity*). On the whole, however, the probability of recovery is greater among women than in men.

From the statistics of Hanwell, by Dr. Thurnam, from 1831 to 1841, the recoveries *per annum of the cases under treatment* have been 5½ *per cent.*, and the average time required to effect the cure has been between four and five years. The following general result is stated by Dr. Thurnam, and is most important to be held in remembrance regarding the prognosis:—namely, That in round numbers, of ten persons attacked by Insanity, five recover, and five die sooner or later during the attack. Of the five who recover, not more than two remain well during the rest of their lives; the other three sustain subsequent attacks, during which at least two of them die. All recoveries cannot, therefore, be regarded as permanent or stable; and the broad rule may be laid down, that when Insanity has once exhibited itself, there is ever afterwards a tendency to relapse; and of the insane in public asylums for the reception of all classes, about 70 *per cent.* may be reckoned as incurable. The intervals of recurrence or relapse are very uncertain, varying from a month to thirty or forty years.

Intercurrent bodily diseases in the insane are of great importance in forming a prognosis, and demand the careful study of the Physician; inasmuch as they are exceedingly insidious and exceptional in the insane as compared with the sane. In the insane the characteristics of bodily disease are masked or obscured by an inertia or torpor of the nervous system. Their febrile

type is generally typhoid or asthenic. There is an absence frequently of symptomatic fever. No complaint may be made, and no external evidence of pain or suffering may be given in cases even of *acute phthisis*, where subsequent *necropsy* shows the lungs riddled with vomicæ and full of pus (vol. i., p. 42); or in cases of *phlegmonous erysipelas* going on to the formation of pus in the limbs; or in *pneumonia*, where the lungs are solidified, and normal respiration impossible; or in *organic diseases of the heart*, in *gastritis*, and in other painful diseases, such as *cancer*, *enteritis*, or *peritonitis*. The possibility of Bright's disease should not be forgotten. Surgical operations may be submitted to without a murmur, as if feeling were completely obsolete. The most serious chest diseases may run their course without cough or expectoration; the excito-motor nervous system would seem to be nearly inert or torpid, and concentration of thought or attention in the insane is in a great measure or quite lost. Sooner or later progressive emaciation and debility, languor, lassitude, and indolence, perhaps anorexia or sleeplessness, direct attention to the state of the patient, in whom the physical signs then show the extent of the apparently latent disease, perhaps rapidly advancing for some time before towards a fatal termination (Dr. Lindsay). The usefulness of the thermometer in detecting such latent disease ought not to be forgotten (see vol. i., pp. 41-56). Dr. Lindsay further notices how the type or aspect of Insanity may be quite changed by fatal bodily disease. A patient, from having been passionate, fretful, and abusive, may become affable, mild, and docile. The dying patient sometimes becomes sane towards his last moments, death being preceded by a bright though transient flicker of the light of reason; and the sufferer has even expressed himself serenely, contentedly, happily, as to his latter end, and his transition from life, with all its troubles and diseases, to eternity, with all its joys and comforts (*Thirty-first Report* of the Murray Royal Institution, near Perth, p. 14). The mind may even then be soothed by the hopes and consolations of religion. "The cloud, though not wholly removed, may yet be tinged with a silver lining, and the music of the Gospel truth may help, like the harp of David, to charm the troubled spirit to repose" (Rev. W. D. Knowles, *Thirty-seventh Report*, l. c., p. 297). Such *euthanasia* for the insane is surely to be desired. That Insanity also is sometimes vicarious, or alternates with other diseases,

must be remembered in prognosis. It is so sometimes with phthisis, one of the most common complications of Insanity. When the phthisis becomes acutely developed, the patient may become temporarily sane, and *vice versâ*.

In the period of convalescence the return of the correct exercise of Judgment is an uncertain and fallacious indication of cure, so long as the Emotions are perverted even in a slight degree from their normal conditions; but immediately the Emotions are controllable and proper, the cure may be considered complete, (BUCKNILL, *op. cit.*)

The mortality among the insane (based on the average population of a mixed county asylum, according to Dr. Thurnam) is considered decidedly unfavourable if it exceeds 9 or 10 *per cent.;* a mortality less than 7 *per cent.* is highly favourable. The largest mortality is from *dementia*, the least from *monomania;* in the latter, indeed, where there is no tendency to suicide, the duration of life is little abridged; so that premature death is almost in all cases owing to accidental and often preventable causes. Expectancy of life in the insane, in relation to Life Insurance, thus involves questions of great pecuniary importance. Popular as well as professional errors exist on the subject. The insane are separable into classes, each of which within certain limits is characterized by a different chance or expectancy of life; but statistics on the subject are greatly required (see Dr. Lindsay's *Thirty-second Report*, p. 17).

Treatment.—The treatment of Insanity resolves itself into the *medical* and the *moral* treatment. Medicine indirectly acts upon the brain, as it does upon other organs, so as favourably to influence the course of the disease. It regulates the different actions and secretions of the viscera of the body, and thus improves the general health, so that the happiest results are often obtained by the early and judicious use of medicinal agents.

"Cases of severe mental despondency and distress—instances of alienation of mind associated with hallucinations, and with apparently chronic and fixed delusions, accompanied by strong suicidal and homicidal feelings—have all yielded to medical treatment; and thus persons in all grades of life, who, if those conditions had not been fully appreciated, would have fallen victims to their own insane impulses, have been restored to society in a state of mental health. The symptoms which so generally precede

the act of suicide—such as depressed spirits, distress of mind, needless alarms and apprehensions as to some foreboding evil, great irritability of temper, and inability to attend to the ordinary occupations of life, excitability, headache, disturbed or sleepless nights, morbidly exaggerated views of the actual ills and circumstances of life—are in many cases certain signs of acute disorder of the brain, requiring medicinal relief, and being manifestly and rapidly benefited by prompt and energetic medical treatment" (WINSLOW).

No uniform method of treatment can be taught. Generally it may be stated that the more the symptoms approach those of *cerebritis, encephalitis,* or *meningitis*—in other words, in proportion as they indicate active inflammatory action—general and local blood-letting may be advisable, *but only in cases otherwise suited for such methods of cure.* Local bleeding is not to be confined to the head, for it not unfrequently happens that it may be adopted with reference to a distant viscus. Leeches to the *vulva* and thighs are beneficial in cases of *mania, monomania,* or *melancholia,* concurrent with the menstrual period; and to the *sphincter ani* in those cases obviously connected with suppressed hæmorrhoids or hepatic congestion. In some instances leeches may be applied with benefit to the Schneiderian membrane, particularly in those cases occurring in early life, and in persons of plethoric constitution and of sanguine temperament. Illusions of hearing or of vision, which had embittered the patient's life, have been removed by leeching behind the ears or over the supercilliary ridges. The utility, in *acute mania,* of prolonged hot baths, is much insisted upon by Dr. Winslow. The patients remain from eight to fifteen hours in them, at 82° to 86° Fahr., whilst a current of water at 60° is continually poured over the head. Various details of what is now known as hydropathic treatment have recently been introduced into English asylums, such as the Russian or vapour bath, the wet sheet, pack, &c.

Sedatives, or agents which modify directly the condition of the cerebral tissue, constitute very valuable remedies. In recent acute cases they are generally admissible; but it is in the various chronic forms of *melancholia* that they are most useful. Dr. Winslow observes,—

"In suicidal Insanity, when local cerebral congestion is absent, and the general health and secretions are in good condition, the *meconate* and

hydrochlorate of morphia often act like a charm, if *uninterruptedly and perseveringly given* until the nervous system is completely under their influence."

Radical cures have been effected by the occasional local abstraction of blood from the head, the administration of alteratives, the warm bath, and sedatives. Success from the use of sedatives often depends upon a *ready adaptation of the form of sedative to the description of case in which it may be deemed admissible, and a judicious admixture of various kinds of sedatives.* With respect to *opiates*, "that medicine which will allay watchfulness in one will not in another, but, on the contrary, increase it. This is particularly the case with opium, which is rarely found admissible in Insanity in its crude state. It more frequently creates heat and general febrile action than sleep" (SIR WILLIAM ELLIS). In cases, however, of recent excitement, *morphia* in considerable doses has been found most beneficial. So also will *chlorodyne* and *chloro-morphine* be of use in some cases. *Indian hemp* is an extremely useful sedative, not hitherto appreciated sufficiently, for many reasons. (See an excellent paper on its uses by Professor Russell Reynolds, in Beale's *Archives*, vol. ii., p. 154.) It relieves pain, is *soporific, anodyne, antispasmodic;* and while conducing to sleep, promotes at the same time *diaphoresis* and *diuresis*, without producing headache, vertigo, constipation, or impairing the appetite. The dose varies from *one-sixth to one-half grain for a child*, and from *one-third to one grain and a half for an adult.* In cases of mental or emotional disturbance it will be found extremely useful, especially where there is deranged cerebral circulation, with pain and delirium; in cases of incipient Insanity after fever or *sunstroke;* and in cases of *senile ramollissement.* Recently *digitalis, conium, belladonna*, have been extensively employed as calmatives.

Endermic medication in Insanity offers numerous advantages, but, in the opinion of Drs. Winslow and Laycock, is too little practised. "In some chronic forms of Insanity—in *dementia* and persistent *monomania*, connected, as was supposed, with morbid thickening of the dura mater, and with interstitial infiltration of the membrane, as well as with exudations upon its surface—the head having been shaved, a strong ointment of the *iodide of potassium* combined with *strychnine* has been perseveringly rubbed over the scalp. In other instances the shaved head has

been painted with the mixture of iodine; and both modes of treatment have been attended with benefit. When the mental symptoms are supposed to be associated with effusions of serum, *iodine* applied externally at the same time with minute doses internally of *calomel* or *mercury with chalk* (so as slightly to affect the system) are recommended. This treatment, conjoined with occasional tonics, diuretics, and stimuli, to support the vital powers, is occasionally productive of considerable benefit in cases apparently placed quite beyond the reach of improvement or cure." A *solution of iodide of potassium* constantly applied to the shaven scalp has been followed by improvement in the mental state. Cases of *dementia*, the consequence of scrofula, are those in which endermic medication will yield the most satisfactory results (Laycock in *Med.-Chir. Review* for Jan., 1857). *Hypodermic injections*, especially of calmatives and soporifics, have also recently been employed; but their action is so irregular, and there are so many sources of danger, that their use can scarcely be commended.

Purgatives may be regularly required. When the bowels are constipated, the form is best determined by the state of the tongue, and sometimes by the idiosyncrasies or proclivities of the patient in regard to medicine-taking. Supposing the tongue to be white and coated, the *sulphate of magnesia*, or other neutral salt, combined with *tincture of hyoscyamus*, in the proportion of ʒj. of the former to ♏ xv. to ♏ xxx. of the latter, in *camphor mixture*, is a formula to be recommended. If, on the contrary, the tongue be clean, the cathartic should be given with some slight bitter, as the *infusion* of *orange peel* or of *gentian*. In some cases the bowels are not only exceedingly obstinate, but the patient may be greatly averse to all medicines. In such cases one or two drops of croton oil placed on the tongue or introduced in food produces free evacuations.

Mild purgative treatment formed the basis of cure in the school of Pinel and of Esquirol; and they usually combined it, in cases of violence, with the application of cold to the head, and of warmth to the lower parts of the body, such as placing the patient in the warm bath and giving him the cold douche—a remedy since more particularly insisted upon by Dr. Brierre de Boismont of Paris, and Dr. Winslow of London. The further treatment consists in restoring any other functions that may be

in defect or in excess, as the functions of the uterus in the female, and of the liver or heart in both sexes, by the usual remedies applicable for these purposes.

The Moral treatment is by many supposed to constitute the more efficient mode of cure in Insanity; and it must be admitted to be a most important adjunct. The first important rule is to remove the patient at once from his family: in slight cases, in order that he may be induced to exercise such command over himself as he possesses, and to remove him from influences which may have been aggravating his morbid state; and in severe cases, in order to prevent his doing mischief either to himself or others,—are the reasons for this practice. The main feature in the Moral treatment of the insane in this country is the abolition and absence of mechanical coercion or restraint. The beneficial action of this system, generally known as "*the non-restraint system*," is now thoroughly recognized in England and Scotland, where it has been gradually established in every asylum since 1847-48. But there are certain exceptional phases of Insanity in which some mechanical restraint is the most humane mode of treatment —the only mode, indeed, of avoiding certain catastrophes of too common occurrence. In certain conditions of excitement, however, it is proper to place the patient at once in a darkened room, remote from noise and the means of injury to himself or others, so that as few objects as possible may irritate him, just as a patient with his eyes affected is kept in a darkened room. The effect of such seclusion is generally of a soothing character; and in not a few cases of periodic mania it is eagerly sought by the patients themselves.

As convalescence advances the patient should be induced to undertake some manual labour, or some office in the asylum or household, which, by amusing his mind, will invigorate his body, and greatly tend to restore the healthy working of his brain. There are no more powerful moral medicines than "Occupation," "Recreation," and "Education." Occupation should be such that no time is left for idleness, or for sitting brooding over morbid fancies. The curative results of well-chosen means of Recreation cannot be over-estimated. When the circumstances of the patient admit of it, travelling, which embraces change of air and change of scene as well as exercise, is often highly salutary in incipient cases; and much has of late been done by the judicious introduc-

tion of music and other amusements into asylums. Thus, concerts, balls, conversaziones, evening entertainments, pic-nics, excursions, *fêtes champêtres,* athletic games, pedestrian excursions, public amusements in towns, and carriage drives, are all legitimate and well-approved means of maintaining a constant and varied succession of recreation adapted for all classes of the insane. When Reason is restored, and the Affections again fix themselves on their natural objects, *and when the Emotions are under control,* the patient may be allowed to see his friends, and have his attention directed to the affairs and interests of his family; but it should be remembered that the mind remains weak and enfeebled for some time after apparent recovery: and consequently the patient's restoration to society should be gradual.

With regard to diet, it only requires to be stated that it is often necessary to have recourse to artificial alimentation by the stomach pump in exceptional cases, when food is persistently refused.

An Hospital for the Insane, or Lunatic Asylum, is the most fit and proper place for a "person of unsound mind;" and every asylum ought to be governed by one superintendent, who should be a medical man—an officer of health to the community over which he presides. He ought to have the means of controlling all sanitary arrangements in whole and in detail,—of avoiding overcrowding,—of preventing and destroying effluvia,—and of examining the quality of the food, the water, and the drugs furnished to the establishment. Chemical and pathological appliances ought therefore to be at his disposal for his use. The number of patients who may be thus under the supervision of one medical head in an asylum ought not to exceed 200 (ESQUIROL, AMERICAN COMMISSIONERS IN LUNACY). Premature removal from asylum treatment in opposition to medical advice is greatly to be deprecated; and its baneful results are frequently to be seen, especially in the sad endings of cases of *suicidal melancholia.* In such cases an acknowledgment should be required of the recipient of the patient, or his friends, that he is removed notwithstanding the assurance given by the medical superintendent that the patient is not recovered, and is unfit for removal (Dr. Lindsay, *Thirty-second Report,* p. 14). Such removals not unfrequently induce a change of type from acute and curable to chronic and incurable mental disease.

The subject of Insanity has been treated of in this text-book

because it is a subject which medical men are expected to study, and to be called upon to treat and to deal with in a medical and also in a medico-legal point of view. They have, however, few opportunities at our schools of medicine of studying Insanity as they would any other disease in a general hospital.* They are, therefore, often called upon to give certificates of Insanity, without perhaps having ever seen or studied a case; and many recent legal decisions have shown that it is not always safe for a medical man to incur the responsibility of signing such certificates, in the present state of the law relating to lunacy. Seeing, also, that the legal and medical views of Insanity are not in unison, nor in accordance with what is known as the correct pathology of the disease, the subject has been treated of as fully as time and space would permit. To learn this important subject in all its bearings, the student is recommended to study the comprehensive work so often quoted and referred to in these pages—namely, the *Manual of Psychological Medicine* of Drs. Bucknill and Tuke, of which a second edition has been recently published; and the valuable reports of the Murray Royal Institution for the Insane, near Perth, prepared by Dr. Lauder Lindsay.

CHAPTER VI.

PATHOLOGY OF DISEASE OF THE SPINAL CORD, ITS MEMBRANES, AND THE NERVES.

SECTION I.—DISCOVERIES REGARDING THE STRUCTURE AND FUNCTION OF THE SPINAL CORD AND NERVES.

THE doctrines regarding the nature of the diseases associated with the structure and functions of this portion of the nervous system are in a state of transition. The inquiries into the structure of the cord, the arrangement of its minute component parts, and their connections with each other—with the brain on the one hand, and with the different parts of the body on the other—are

* There are exceptions: at Edinburgh, where Professor Laycock and Dr. Skae—in London, where Drs. Sankey and Blandford—and at Aberdeen, where Dr. Jamieson—deliver regular clinical lectures.

only yet being investigated with all the care and appliances of modern research, and to some extent elucidated with success. Difficulties of the most formidable kind surround the anatomical, physiological, and pathological relations of the structures, functions, and diseases of the spinal cord and nerves. Much labour is required, in the first instance, to expose the cord in the dead body, and to examine its morbid states; while delicate manipulations and unwearied research, by the most experienced observers during the last half century, have served alike to show how mysterious and difficult is the subject in all its bearings, and how important and interesting the results. In this arduous task the names of anatomists, physiologists, and the busiest of physicians of this country have, in all such recent investigations, borne a distinguished and pre-eminent part.

In 1811 Sir Charles Bell took the initiative in these researches, and surprised the scientific world by his beautiful and interesting discovery regarding the distinct functions of the *anterior* and *posterior* roots of the spinal nerves.

The epoch of another era is marked by the interesting indication of the existence of the property of "*reflex action*," foreshadowed by Unzer and Prochaska, but which the ingenious and important investigations of the late Dr. Marshall Hall so largely contributed to develop. The names of John Reid, Grainger, Swan, Solly, R. B. Todd, and Bowman, stand prominently forward in this line of inquiry.

A third era is characterized by careful records of the history of cases, by the most inquisitive microscopic research into the diseased parts after the death of the patient, and by physiological experiments in living animals, to show the connections and arrangements of the more minute component parts of the spinal cord (see results of a series of microscopic studies of the *medulla oblongata*, by Dr. John Dean, vol. xiv., "*Contributions to Knowledge*," by the Smithsonian Institution, U. S., America). In this field of research the labourers are not few; and our own country is especially distinguished by the observations of Mr. Lockhart Clarke, the late Dr. R. B. Todd, and Mr. Bowman, Drs. Beale, Handfield Jones, Edward Meryon, J. W. Ogle, Roberts, and Bastian. Abroad, the persevering industry of Kölliker, Valentin, Stilling, Remak, Engel, Van der Kolk, Wagner, Brown-Séquard, and De Bois Reymond, and many others, have thrown much light on

most of the important questions regarding the structure and functions of the spinal cord. But "let not the spark be lost in the flame it has served to kindle." The beautiful discovery of Sir Charles Bell, while it astonished the scientific world at the time, soon expanded in magnitude and importance. From it, as from a mighty tree, the boughs that have dropped from its parent stem have borne to the earth those living blossoms which, germinating in their turn, are now daily expanding their branches into every land where the Science of Medicine is advancing.

It may be useful, in studying the nature of the diseases associated with the structure and functions of the spinal cord and nerves, to have a distinct conception of the more important general points which seem to have been established relative to its anatomy and physiology, and how far these are illustrated and supported by observations on its morbid anatomy. The following is a condensed statement of the general results established by the prolonged labours of Professor Schroeder Van der Kolk, of Utrecht, a more extended detail of which may be seen in *The Medico-Chirurgical Review* for January, 1857; and which are consistent in many respects with the observations of Valentin and Stilling:—(1.) The spinal cord (including the *medulla oblongata*) is the instrument through which the power of motion is generated and expressed, and the co-ordination of movements effected, and through which sensation is transmitted to the brain, and to the grey cerebro-spinal matter of the cerebro-spinal centres. (2.) Complete division of the spinal cord abolishes sensation and voluntary motion in all those parts of the body supplied with spinal nerves from below the seat of injury. Any lesion of the nerve-substance which results from a disease-process may do this if it destroys completely the nerve-matter at the seat of lesion. According to the region in which such a lesion may be situated, so are the different forms characteristic of this loss of power. The nearer the brain and *medulla oblongata* the more immediately fatal to life. If, at the junction of the cord with the *medulla oblongata,* such an injury were to happen, immediate death would ensue, as may be seen when an animal is "*pithed.*" Generally speaking, from the head downwards the parts of the body are supplied, *seriatim,* by the nerves coming off from the spinal cord, so that according as the injury to the cord is situated

lower and lower down, so does the paralysis affect less and less of the body from below upwards to the seat of disease. Thus in the cervical region, below the origin of the phrenic nerve, when the lesion is throughout a complete segment of the cord, and above the origin of the superior intercostal nerves, breathing is performed only by the diaphragm and abdominal muscles, while the intercostal muscles cease to act, and the ribs cease to rise and fall. In this condition the patient may live a few days, seldom a week, and never a month (WATSON). If the lesion of the segment occurs below the cervical region, in the upper dorsal portion, for example, the breathing is not affected, or but slightly, while the digestive functions become impaired, and paralysis of the trunk and lower limbs is complete. Such a condition is technically called *paraplegia*. It implies palsy and loss of feeling in the lower limbs, hips, loins, and trunk, according as the injury is higher or lower in the dorsal or lumbar region of the cord. A person in this condition may live a long time, depending greatly on the seat of injury; the higher up, generally the sooner fatal. (3.) The nerves which issue from the cord by two roots (motor and sensific) unite and form compound or mixed nerves, whose filaments or strands pass from their origins to their destinations isolated from each other; and everywhere throughout the body the sensific ramifications of the mixed nerve pass to the surface of the part which is moved by the muscles receiving their motor fibres from the same compound nerve; so that, while the former supply sensation to the part, the latter convey the stimulus to excite the act of motion (VAN DER KOLK). (4.) The anterior (*motor*) and posterior (*sensific*) roots of the compound or mixed spinal nerves are now determined to have certain relations with the grey corpuscular elements of the spinal cord, accumulated throughout its central part in such a manner that a transverse section of the cord shows anterior and posterior *cornua* of this corpuscular grey substance. The corpuscular or multipolar cells, constituting the grey matter, are arranged in several distinct vertical columns, extending throughout the whole length of the cord, the anterior column being the principal. The most considerable of these cells constitute the columns of the anterior horns; next, those by the posterior commissure; then those between the anterior and posterior horns; and, lastly, those in the posterior horns, which rank the smallest in size, and it is even douhted by some whether they

are really nerve-cells. These columns of corpuscular nerve-cells are larger and richer in nerve-cells at the cervical and lumbar enlargements; and the proportion of cells increases still more at all those points where the roots of the nerves penetrate into the cord to its grey substance. Thus, clusters of cells, occurring more or less apart, are placed above each other longitudinally (CLARKE, VAN DER KOLK). These so-called nerve-cells are extremely simple in structure. They consist of a more or less rounded mass of matter (cells?), having two or more caudate prolongations, with a circular centre or nucleus and nucleolus containing granular molecules. (5.) The anterior roots (*motor nerves*) spring from the cord itself, and take their origin out of the ganglionic cells of the anterior horn, each cluster of which forms a ganglionic plexus. (6.) The anterior medullary fibres of the cord are the channels through which the influence of the Will from the brain is conveyed to these corpuscular or ganglionic plexuses, whence these motor nerves take their origin. (7.) The posterior roots (*sensific nerves*) have been traced towards groups of ganglionic cells, but have not been shown to communicate with them. (8.) These posterior roots have been traced to subdivide into two portions, which may be called sets of radicles or rootlets. At the posterior part of the cord one set of these posterior nerve-roots ascends immediately in the white substance, and appears to proceed directly towards and into the brain, thus constituting the channel of sensation; the other portion of the posterior nerve-roots transversely penetrates the white substance of the cord towards the posterior horn of the grey matter, through which it passes. Its fibres there mingle, in part, with certain nerve-fibres which are observed to encircle in a transverse direction the posterior horn of the grey substance of the cord; and, in part, they lose themselves amongst the ganglionic cells of the centre of the grey matter, between the anterior and the posterior horns. (9.) These latter rootlet nerve-fibres, of the great posterior roots, thus constitute the apparatus of reflex action, directing their stimulus through the group of ganglion-cells, with which they appear to be connected, into the ganglion-cells of the anterior horn, from whose plexus of cells the filaments of the motor roots arise. The posterior nerve-roots include, therefore, two descriptions of nerve-fibres—namely, those for sensation proper, and those for reflex action; and hence the greater thickness

(more than double) of the posterior roots compared with the anterior. (10.) These different cell-groups or plexuses of corpuscular cells appear to be united throughout the cord by longitudinal connecting-fibres, so that co-ordination of movement is effected. (11.) The roots of the motor nerves thus receive the excitement or stimulus to action from the group of ganglionic cells in which they originate. It is communicated to them, either through the Will anteriorly, and from above downwards, or by the sensific nerves by their reflex filaments posteriorly, and from the peripheral parts of the body with which the sensiferous nerve-filaments are connected. An individual group of corpuscular cells (whence the motor roots arise) thus becomes susceptible to a *psychical* as well as to a *physical* stimulus. (12.) All reflex action takes place by a definite channel; and its operation seems to be regulated by communicating fibres, which bring the different plexuses of nerve-cells into communication with each other. Thus co-ordination and combination of movements are explained; and so also is the diffusion of action over remote regions, especially in great irritation of the cord, as in attacks of epilepsy and tetanus, or while the system is under the influence of the strychnine poison or hydrophobia. (13.) The grey matter of the cord seems chiefly to avail for *motion;* the posterior part being chiefly subservient to *reflex function*, and to the *co-ordination of motion;* while *sensation* is transmitted upwards exclusively by the posterior and lateral medullary columns to the encephalon, and has probably its proper centre in the *medulla oblongata.* Here, also, is probably localized the centre from which the more universal reflex movements and convulsions take their origin. Experience has convinced Professor Van der Kolk that the attention of the Physician ought to be directed to the condition of the *medulla oblongata* in cases of epilepsy. He has frequently succeeded, where the disease has not been of long duration, in procuring a recovery through derivative applications to the nape of the neck; while the pathological changes resulting from protracted epilepsy are not unfrequently manifested by induration of the *medulla oblongata.* The morbid state of the spinal cord, which I accurately determined to exist in *four* cases of tetanus, is also consistent with statements regarding its minute anatomy and the relation of its parts. Each of the four cases exhibited one character in common, and pointed out the spinal

cord as the seat of lesion in that formidable malady. The lesion referred to was not manifest to the naked eye, but was determined to exist with certainty by an examination of the specific gravity of the cord-substance. For this purpose the cord was separated from its nerves, and divided into parts of a uniform size, and the specific gravity of each determined. "Each of the four cases showed that the general specific gravity of the spinal cord throughout is increased in cases of tetanus, the average specific gravity of the healthy cord being 1·036. They showed, also, that a change is *suddenly* indicated about the region of the cord in immediate communication with the wounded part, and that in one case of idiopathic tetanus the change was uniform throughout. In the first case I examined, where the wound was on the occiput, the uppermost three inches of the cord were of the highest specific gravity, and the difference became *suddenly*, and *not gradually*, manifest at the fourth inch. In the third case a very marked difference was apparent when the cervical region was compared with the rest of the cord; and the difference was suddenly marked where the roots of the cervical and first dorsal nerves left the cord to form the brachial plexus. The wound in this instance was on the fingers. "In the last case the difference was suddenly manifested in the lowermost part of the cord, corresponding to the region where the nerves were in communication with the lower limbs, which were the seat of the injury" (*Glasgow Med. Jour.*, No. IV., Jan., 1854). Mr. Lockhart Clarke has since examined the cord in tetanus cases microscopically, and has found peculiar lesions of a most minute kind scattered throughout its substance (*Med.-Chir. Reports*, August, 1865); and more investigation shows a great increase in the growth of cell elements in the implicated portions connected by nerves with the site of injury. (14.) The anterior commissure of the cord is distinguished from the posterior by the decussation of the fibres. After their intersection, when traced downwards, these fibres are observed to be deflected so as to run in part along the margin of the anterior fissure, interlacing themselves within the white substance; and in part to enter the inner edges of the anterior grey horns, where they mingle with the encircling fibres already noticed, which spread themselves thence in the medullary columns of nerve-cells and join the longitudinal fibres. Their function is probably to

maintain the motion of the right and left sides of the body. The fibres of the posterior commissure have a parallel course, without any intersection. (15.) Some observations on the secondary affections of the cord by Dr. Turck seem to show that when disease destroys a certain portion of the nervous centre, the strands, filaments, or cords of nerve-substance which proceed from that centre, or arrive there, subsequently degenerate, having ceased to receive or to convey an impulse. This degeneration takes place in the same direction in which these strands or filaments convey impressions; thus in the centripetal fasciculi (posterior columns) the secondary affection occurs always in the centripetal direction; while in the centrifugal fasciculi (anterior columns) it shows itself in the centrifugal direction; and in the mixed fasciculi (lateral columns) it shows in both directions. Thus it happens that secondary affections of filaments or strands of fibres in the spinal cord may result from a lesion in one of the hemispheres of the brain; generally in about five weeks after the primary injury.

This observation may be regarded as a rule; and to some extent it may also explain cases of so-called "*paralysis musculaire progressive*" which have been described by Meryon, Cruveilhier, Aran, Valentiner, and Roberts; although the nervous lesion has only been demonstrated in some of the cases.

CHAPTER VII.

DETAILED DESCRIPTION OF THE DISEASES OF THE SPINAL CORD.

SPINAL MENINGITIS.

LATIN, *Meningitis spinalis;* FRENCH, *Méningite spinale;* GERMAN, *Entzündung der Häute*—Syn., *Meningitis spinalis;* ITALIAN, *Meningitide spinale.*

Definition.—*Inflammation of the membranes of the spinal cord.*

Pathology.—The inflammatory states of the membranes of the cord, and the morbid effects they produce, are the same as those of the membranes of the brain—namely, serous effusion, which may terminate in suppuration or softening.

The rachidian *dura mater* may be inflamed either at its free or

at its adherent surface. On examining the spinal canal, after caries of the vertebræ, the areolar tissue uniting the dura mater to the walls of this cavity is often found greatly loaded with venous blood, and in some instances is broken down, so that the dura mater is entirely detached—a state most probably due to inflammation. This inflammation may terminate by resolution, or it may advance, and serum be effused between the osseous structure and the dura mater. In this site the effusion has no communication with the cavity of the cranium, because the dura mater of the cord, while it is but loosely attached by areolar tissue to the vertebræ, is very firmly attached round the margin of the *foramen magnum*, and especially to the basilar portion of the occipital bone.

The *dura mater* of the cord also appears liable to the ulcerative process and to gangrene. In a case given by Ollivier (vol. ii., p. 569), of a druggist who died on the twentieth day, after suffering from lumbar pains, with rigidity of the trunk and lower extremities, together with tetanic spasms, there was found, on cutting through the muscles of the lumbar region, half an ounce of pus, or more, which was traced to the cavity of the arachnoid, the rachidian *dura mater* having ulcerated and ruptured.

The spinal *arachnoid* and *pia mater* are liable to inflammations similar to the corresponding membranes of the brain.

Diffuse inflammation of all the folds of the *arachnoid* has often been observed; those membranes being red and injected for a greater or less extent.

Effusion of serum, both into the cavity of the *spinal arachnoid* and between the *dura mater* and *pia mater* of the cord, is not uncommon. Such effusion communicates freely with the cavity of the cranium, so that fluid may pass easily from the one to the other.

Suppurative inflammation of the spinal membranes also occasionally takes place in the cavity of the *arachnoid*. Frequently, if the inflammation is acute, it is associated with disease of the *cerebellum*, or of the intracranial membranes; and in the chronic form it rarely exists, except in connection with caries of the vertebræ.

Effusion of fluid within the cavity of the spinal cord is analogous to fluid in the ventricles of the brain. It leads to compression of the cord, and paralysis as a symptom of such compression. *Hydrorachis*, as it is termed, is usually a con-

genital state, associated with a defective development of the vertebral arches. The paraplegia it induces generally extends to the sphincters and the bladder, producing incontinence of fæces and urine. The condition is indicated by a tumor at the lower end of the canal, over the region of the sacrum; and the cavity of such tumors communicates with the cavity of the vertebral canal; and the paralyzing influence is occasioned by the pressure of the fluid on the spinal cord. Congestion of the membranes may occur as a stage preliminary to all of these conditions.

Symptoms.—The symptoms of *rachidian arachnitis*, or *meningitis* of the cord, are often obscure at the commencement; but once formed, the disease is characterized by pains in the back, with affection of the muscles, and retention of urine. Paralysis does not occur, except by pressure produced by exudation of fluid, or by extension of inflammation and disorganization of the cord itself (MERYON). Ollivier, quoted by Meryon, gives a case of spontaneous *spinal meningitis*, in which the symptoms closely resembled those of structural lesion of the cord itself. The patient, a man aged twenty-four, was admitted into the Hôtel Dieu with obscure symptoms. On the fifth day of the disease he had paraplegia, with hyperæsthesia of the lower extremities. Three days afterwards the arms became partially paralyzed, semiflexed, and stiff; the right pupil was more dilated than the left; the association of ideas was slow. Two days subsequently he died. The cellular tissue which surrounds the dura mater of the spinal canal was filled with vessels injected with blood. The spinal cord was enveloped in a layer of gelatinous yellow matter, between the arachnoid and pia mater. It was most abundant over the lumbar enlargement, and extended as high as the third cervical vertebra. It was thickest where it covered the posterior columns of the cord (*Traité de la Moelle Epinière*, tome ii., p. 551, 2me edition).

One marked symptom of congestion of the membranes, referred to in a case related by Dr. Meryon, is the difficulty experienced in walking on first arising after a night's rest. I have observed this to be a constant indication of spinal congestion; and it may be temporarily induced by *strychnine* or *nux vomica*.

The affection of the muscles varies from simple stiffness of the part to *opisthotonos*. This latter symptom is often limited to the neck or trunk, without the limbs participating, as in a case given by Rayer, in which the trunk and neck were drawn backwards,

while the patient walked freely till the time of his death. In the case of a waggoner thrown off his cart, and pitched on his neck and shoulders, the neck was stiff, the jaw was locked, the body convulsed, and the patient delirious. It was not till the twelfth day, however, that the lower extremities became affected and palsied, when the patient sunk into a typhoid state and died. A large quantity of pus was likewise found in the spinal arachnoid cavity. Neither the pulse, nor the tongue, nor temperature, is much affected at the commencement of *spinal meningitis*, but towards its close the pulse becomes rapid and feeble, the tongue brown and dry, and the teeth fuliginous. The patient is now said to be "*typhoid*," and he dies delirious or comatose. Retention of urine generally persists from the beginning to the termination of the disease. Constipation often exists to a great degree at first, but afterwards the bowels act regularly, or even suffer from diarrhœa.

Diagnosis.—The symptoms which distinguish *spinal arachnitis* from inflammation of the substance of the cord are *pain* and *contraction* or *convulsions* of the limbs; for in pure *myelitis* there is seldom any severe or constant pain, while the limbs are generally palsied, and their sensations benumbed or lost. It is distinguished from *rheumatic lumbago* or *psoas abscess* by the affection of the limbs and of the bladder.

Prognosis.—Many authorities consider *spinal arachnitis* to be incurable, but numerous cases marked by the characteristic symptoms in a mild form do recover.

Treatment.—Spinal *arachnitis*, seldom depending on a morbid poison, is perhaps in all cases best treated by bleeding and mild purgatives. General bleeding is sometimes necessary; but local bleeding, either by cupping or leeches, along the vertebral column, is most useful, and cannot be omitted with safety. The medical treatment consists in moderate purging by the neutral salts, as the *sulphate of soda* or the *sulphate of magnesia;* for, as these act on the bladder as well as on the bowels, they are probably the best remedies. But whatever purgative may be selected, it will be proper to combine it with the *tincture of hyoscyamus*, or other mild opiate, to procure the patient some relief from his sufferings. Ergot of rye (*secale cornutum*) has been very much used in France; and Dr. Meryon speaks favourably of its effects, combined with *iodide of potassium*, in a case which manifested no

complication of spinal effusion (*Medical Times and Gazette*, Aug. 31, 1863). The warm bath is an excellent adjuvant in the earlier stages of the disease; whilst in the latter stages *blisters, setons, moxæ,* or the *ointment of the tartrate of antimony,* are more beneficial, or at least are deserving of a trial. The paralyzing effusion may disappear during their use, combined with the action of diuretics. The *external* application of *belladonna* and *chloroform* will be found of essential service in diminishing the violent pain which accompanies meningitis of the cord (MERYON). Cold, in the form of bladders filled with ice, applied along the spinal cord, may be of service where congestion prevails.

Abstinence from all animal diet should be imperiously prescribed throughout the whole course of the disease.

In cases of *hydrorachis,* where a tumor is associated with *spina bifida,* iodine injections have been proposed (VELPEAU, DEBOUT, BRAINARD, GROSS, MERYON). In operating, the puncture should be very small, by a small flat curved needle, directed subcutaneously into the sac. A drain of the fluid may then be allowed to escape through a canula, and the injection used must be very weak at first, the object being to excite a slow process of inflammation in the cyst. One-eighth of a grain of *iodine,* and a quarter of a grain of the *iodide of potassium* in solution, is the quantity prescribed for injection by Dr. Gross. He then closes the puncture with a twisted suture, and coats it over with collodion. An anodyne should be administered, and the child kept lying on its face. If the life of the child be saved, paraplegia is still apt to remain, and perhaps involuntary defecation and micturition (Meryon in *Brit. Med. Journal,* July 11, 1863, p. 28; also *Practical and Pathological Researches on the various Forms of Paralysis,* p. 25).

EPIDEMIC CEREBRO-SPINAL MENINGITIS—SYN., CEREBRO-SPINAL FEVER, OR MALIGNANT PURPURIC FEVER.

LATIN, ——; FRENCH, *Fièvre cérébro-spinale* — Syn., *Fièvre purpurée maligne;* GERMAN, *Epidemische meningitis;* ITALIAN, *Febbre cerebro-spinale*—Syn., *Meningitide cerebro-spinale.*

Definition.—"*A malignant epidemic fever of an acute specific character, of sudden invasion, attended by painful contraction of*

the muscles of the neck and retraction of the head. In certain epidemics it has been frequently accompanied by a profuse purpuric eruption, and occasionally by secondary effusions into certain joints. Lesions of the brain, the spinal cord, and their membranes, are found on dissection. The course of epidemic cerebro-spinal meningitis is rapid and very fatal, attended with great prostration of the powers of life, severe headache, and pain along the spine.

Pathology.—During the early part of 1865 a disease of this nature prevailed epidemically about the Lower Vistula, and in other parts of North Germany. It had some characters of being a specific fever like *Typhus*, but its characteristic lesions were chiefly on the surfaces and enveloping membranes of the cord. The *pia mater* was found in fatal cases to be swollen and infiltrated, or perhaps suppurating and disorganized. But these changes of the surfaces are also *indicia* of changes more or less destructive within the nerve-centres. Lymph is more rarely effused, yet has occasionally been found organized, uniting the opposite sides of the serous sac together. The *pia mater* and the *arachnoid* have also been found adherent after effusion of lymph; and instances have occurred in which the layers of the spinal membranes have been found united to each other. There is reason to believe that this disease has prevailed as an epidemic in Europe at different periods and different places during the fourteenth, sixteenth, and seventeenth centuries, and in the eighteenth century in France, Germany, Italy, England, Ireland, and Scotland. In the present century it has prevailed at Geneva, in Switzerland, and in some parts of North Germany, and in Ireland, and in the United States of America. The name of the disease is apt to fix the attention on local structural changes (which are probably only secondary, and may not always be present), to the exclusion of a consideration of the real nature of the malady. It has been regarded, therefore, by some as a form of simple acute cerebro-spinal meningitis; but its rapid course and greater severity, and its clinical history, clearly show that it is more than a simple meningitis. The whole of the nervous system is gravely implicated from the first, so that it kills at an early period, leaving no evidence of local structural change. On the other hand, there seems to be no constant relation between the severity and duration of the illness and the extent of the lesions seen after death. Again, there are not a few who regard the disease as a variety

merely of typhus fever (BOUDIN, MURCHISON, UPHAM); and cases are met with, particularly when cerebro-spinal meningitis and typhus prevail together, which favour this view. But it is believed that the suddenness of the invasion, the rapid course, the absence of the mulberry rash of typhus, the early appearance of the purpuric eruption or hæmic spots, are sufficient to distinguish epidemic cerebro-spinal meningitis from typhus fever. Each seems due to some specific poison, which some believe to be of malarious origin; others, again, of the nature of influenza, or of typhoid pneumonia. The exact nature of the disease seems therefore to be still undetermined; and pathologists have rather stated what it is *not* than what it is. So far it can be said that it seems to be a substantive specific disorder, with constant symptoms, and therefore ought, perhaps, to be considered under the general diseases of a specific febrile nature.

Symptoms.—The invasion is sudden; or weariness and a general sense of uneasiness may be felt for a day or two before more acute symptoms set in. Most usually shivering prevails, intense vertigo, headache of intolerable severity, violent obstinate vomiting, and painful muscular stiffness (which soon develops into tetanic contraction), particularly of the neck and back. While consciousness lasts, the distress in the head is incessant, and even during delirium or stupor the patient's instinctive movements show that the head is the chief seat of pain. The eyes are expressive of wild distress, the face generally pale, pupils contracted, and conjunctiva red. Terrible restlessness and general muscular agitation are soon added to other symptoms. Often the sensibility of surface is so great that every touch or movement causes agony. The neuralgia increases, and muscular contractions become more and more uncontrollable and convulsive, affecting, like tetanus, all parts of the body. Deglutition is affected; respiration becomes irregular and imperfect. The head is dragged tightly backwards upon the neck, and the features are fixed in the characteristic grin of lock-jaw. Consciousness becomes effaced, and delirium tends towards stupor, the patient passing into coma, or into a depression on the confines of death. By this time emaciation has greatly progressed, and goes on, from the profuse sweating which is apt to attend the typhoid state, into which he rapidly passes. Anæsthesia, muscular paralysis, drooping of the eyelids, or squinting, are not unfrequent phenomena; the pupils

being dilated, or motionless, or unsymmetrical. When death ensues, it is generally from the fifth to the eighth day; otherwise the duration of the disease may extend over three or four weeks, and convalescence may be of many months' duration. After a few hours, to one or more days, an eruption or marking becomes visible upon the skin of the neck, abdomen, back, arms, legs, and face. It is of a hæmic or purpuric appearance, and made up of distinct dark-red or purple spots, about the size of a pin's head or a little larger. The spots are not raised, nor do they fade on pressure, and in some cases are not visible till after death. The tongue remains moist and creamy till the spasmodic stage becomes developed, when it becomes dry, dark coloured, or even black, fissured and swollen, or covered with sordes. Herpetic eruptions on the lips are not uncommon. The respirations become slow and laboured, and as a fatal issue approaches they become hurried, irregular, infrequent, or stertorous; the heart beats and the pulse becomes quick, feeble, and tremulous, or weak and slow, with cardiac blood-murmurs (Da Costa). The body temperature rarely rises above 100° Fahr. Death is generally by coma, or from paralysis of the heart by lesion of the *medulla oblongata*.

The duration of attack varies from a few hours to many weeks. A fatal issue is recorded in as short periods as three, four, five, six, twelve, and thirteen hours; but more than half of the fatal cases die between the second and the fifth day. Convalescence may begin from the fifth day to the fourth week, or later, and is always tedious. Health is not restored for many months. Relapses are not infrequent, and often mortal. The most frequent complications are—congestion of the lungs; sero-purulent effusions into serous cavities, especially the pleura and joints; erysipelas; sore throat; swelling and suppuration of the parotid gland.

Prognosis.—The disease has been marked by great fatality; and no case can be regarded without great anxiety.

Treatment.—At the outset, stimulating embrocations to the spine and extremities, with moist or dry heat to the limbs, and wrapping in blankets, give some relief. Opium in large doses is the only drug which has appeared to be of any service in subduing the virulence of the symptoms. Quinine, in cases where malaria aggravates the disorder, is also well spoken of. No evidence appears favourable to the use of blood-letting, veratria, aconite, strychnia, alcoholic stimulation, ammonia, camphor, valerian,

musk, or mercury—all of which have been tried. Ether and chloroform inhalation have been of use as sedatives; and tincture of cantharides has been of service in cases marked by extreme depression. Counter irritation, by the actual cautery applied along the spine, or by blisters, has been followed by alleviation of the pain and other symptoms.

MYELITIS.

LATIN EQ., *Myelitis;* FRENCH EQ., *Myélite;* GERMAN EQ., *Entzündung des Marks*—SYN., *Myelitis;* ITALIAN EQ., *Mielitide.*

Definition.—*Inflammation of the substance of the spinal cord.*

Pathology.—As the spinal cord is a continuation of the brain, and similarly composed of medullary and cineritious matter, it is reasonable to expect that its diseases will be similar. Such is observed to be the case. Inflammation of the cord may be diffuse. It is characterized, *post-mortem,* by a few more bloody points than usual, or by a slight red or rose-colour suffusion throughout its substance. There is reason to believe, writes Dr. Abercrombie, that inflammation of the substance of the cord, like the corresponding affection of the brain, may terminate fatally, either—(1.) In the *acute inflammatory stage;* (2.) By *ramollissement;* (3.) By *undefined suppuration;* or (4.) By *abscess.*

The most common affection, however, is ramollissement or serous inflammation, in which the substance of the cord is greatly broken down and softened, so as to be sometimes reduced to a mere pulp; or so diffluent as to give the sensation of fluctuation under the finger. This disorganization may embrace the whole thickness of the cord, sometimes only one of its columns, so that it is of variable extent. It is constant, however, and the centre or *grey* substance of the cord is more softened than that of the circumference or white substance. The ramollissement may exist in the cervical, dorsal, or lumbar portions; but it is most common in the lumbar, and after that in the cervical portions, or in those parts which contain the greatest quantity of *grey* substance, and the greatest number of blood-vessels. The part affected is generally swollen—a circumstance more striking than in similar diseases of the brain, because the spinal canal is large in proportion to its contents, compared with the cranium. The

softened part is also generally ash-coloured or white. Some pathologists have regarded ramollissement of the cord as a particular alteration of the nervous system, resembling the effects of a contusion of soft parts, and the result of shock. It often occurs, however, when no shock has been received, and has not the least resemblance to a contusion of soft parts.

Induration of the spinal substance is another result of *myelitis*, and probably depends upon a form of inflammation in which fibrinous exudation becomes consolidated. Portal states he has found the cord of a cartilaginous hardness, while the membranes were red and inflamed; and Abercrombie gives a similar case.

The substance of the cord may likewise become infiltrated with pus, or it may be collected into an abscess. The fact of infiltration is perhaps questionable; but there can be no doubt of an abscess having occasionally formed in the substance of the cord. Velpeau gives a case, quoted by Dr. Abercrombie, in which an abscess was formed in the right column of the cervical portion of the cord, three inches long and two lines broad, while a smaller one existed in the left column (*Revue Méd.*, vol. ii., p. 217).

Symptoms.—The symptoms of *myelitis* are in general limited to the parts below the injury. In a few cases, however, the effects of the accidents are reflected from below upwards. In general, both upper or both lower limbs are affected; but in a few instances only one limb. The earliest symptoms are recognized in the fingers and toes, in the feeling of numbness, with a sensation of coldness extending up the limb. Shortly afterwards the patient complains of pain in the back, corresponding to the seat of greatest intensity of the inflammation. This is not constant; but when we make pressure with the finger over the spinous processes of the affected part, it may be augmented or only then felt. These symptoms are succeeded by impaired motion, and often likewise by diminished sensation of one or more limbs, followed by paraplegia or other form of palsy. If only one side of the cord be affected, the paralysis which results is confined to one side of the body. When the anterior columns chiefly are the seat of the inflammation, the paralysis which follows is that of muscular motion, but of sensation if the lesion exist in the posterior columns; and if a careful analysis be made of the several cases in which the grey substance of the cord has been implicated, it will be found that the function of reflex action has been

deranged (MERYON). In the early stage, when congestion prevails, there is exaltation of tactile sense and of muscular contraction. Another marked symptom may be often distinguished—namely, a difficulty experienced in walking on first rising after a night's rest—a feature more or less constant in cases of spinal congestion. The palsied limbs may be either relaxed or permanently contracted: thus, the hand may be bent on the upper arm, or a leg be flexed upon the thigh, or the affected limb may be attacked with convulsive twitchings, or may beat incessantly. As the disease advances, the bladder becomes affected, and the patient is incapable of retaining his urine, from the sphincters being palsied. The action of the bowels is slow in the first instance; but towards the close of the disease the patient may be purged, and the stools pass involuntarily. If the disease be the result of an accident, the pulse is at first rapid and full; but if the disease be spontaneous, the pulse is generally natural, until the powers of life are broken down by the continuance of the affection. As death approaches, the nates and the prominent parts of the pelvic region, on which the body rests, ulcerate extensively, so that deep sloughs form; and although the patient, from anæsthesia, suffers no pain, he nevertheless ultimately sinks exhausted.

In *myelitis*, and in injuries of the spine from wounds and contusions, some differences in the symptoms have been observed, according to the seat of the injury. The disorganization of the substance of the cord entails a condition of paralysis more or less extensive, according to the seat and the extent of the inflammation. Every part of the body which receives its nerves from the spinal cord below the upper level of the structural disorganization is paralyzed; consequently, when destructive *myelitis* extends throughout the cord to the *fifth* pair of cervical nerves, the upper extremities are paralyzed, and all those parts which receive their nerve-power from a lower level of the cord are paralyzed too. If, again, the spinal cord be lacerated or divided above the origin of the phrenic nerves, or above the third cervical vertebra, death is the immediate consequence, the nervous influence being no longer transmitted with sufficient completeness to the diaphragm and other muscles of respiration. Petit gives two remarkable instances of this. The only son of a working man went into the shop of a neighbour, who in play raised the child from the ground by

putting one hand under his chin and the other at the back of his head. The child, only six or seven years old, struggled, dislocated his head, and died immediately. There are a few cases, however, in which disease of these parts has not been immediately fatal. Thus, the *odontoid process* has been destroyed by caries, or the second cervical vertebra has been dislocated, and yet the patient has continued to live for some months, or even some years. A remarkable case of a diminished area of the occipital foramen, whence resulted great pressure on the cord, is related by Mr. Holberton in *The Medico-Chirurgical Transactions*, vol. xxiv., p. 180. The patient lived more than two years, the most remarkable symptom being an extremely slow pulse. In these chronic cases the formation of the disease is slow, so that the cord becomes accustomed to the gradually increasing pressure, and the respiration consequently still continues to be carried on principally, though feebly, by the muscles of the neck and shoulders, the diaphragm and intercostal muscles being more or less palsied.

When the injury, however, is below the origin of the phrenic nerves, or at the level of the fifth and sixth cervical vertebræ, the inspiration is free, but the expiration is laborious, for the intercostal and abdominal muscles are paralyzed, and incapable of assisting in that process. The patient can yawn, for that is an act accompanied by inspiration; but he cannot sneeze, for that is an act accompanied by expiration. At this point, also, the upper extremities are still palsied, both as relates to motion and to sensation. When the palsy of motion and of sensation is complete, the patient, during the short remaining period of his life, presents the extraordinary phenomenon of a living head, with its sensibility and muscular powers unimpaired, attached to a trunk and extremities of whose existence he is only conscious by the sense of sight (Brodie).

The circulation of the blood is affected, and the action of the iris of both eyes, through the medium of the sympathetic nerves (Meryon). Another very common symptom connected with injuries of the upper portion of the cord is *priapism*, which may show itself about the second or third day after the accident, and generally subsides after the first fortnight. It sometimes occurs even when all sensation in the part itself is destroyed, so that the patient is not sensible of the introduction of the catheter.

If the injury be in the situation of the sixth and seventh cervical vertebræ, the palsy of motion and of sensation of the upper extremities is frequently imperfect, while it is complete in the trunk and lower extremities.

When the spinal cord has been injured in the part corresponding to the first dorsal vertebra, the upper extremities may still suffer from an incomplete palsy either of motion or of sensation, or both. When, however, the seat of the lesion is in a line with the second dorsal vertebra, the sensation and motion of the upper extremities remain unimpaired, but the respiration is still difficult, from the palsy of the intercostal and abdominal muscles. If the paralyzing influence do not extend through the entire thickness of the cord, then the lower extremities may preserve their sensation and motion, although the arms hang powerless, owing to the disease having dissected out, as it were, the groups of ganglionic cells which determine the action of certain sets of muscles, whilst the conductors of the Will for the movements of the legs pass by unscathed (MERYON). An illustrative case, occurring in the practice of M. Broussais, is recorded by Ollivier. The patient was a medical student, aged twenty-one, who had, as a result of acute myelitis, complete paralysis of the upper limbs, while the legs, as well as the bladder and rectum, retained their healthy power. He died on the eighth day after the attack. There was some increased vascularity of parts of the encephalon, considerable congestion of the sinuses of the cord with fluid blood, and much sanguineous effusion between the dura mater and the vertebral arches opposite the brachial enlargement of the cord, as well as a considerable quantity of red serum between the pia mater and arachnoid at the lower part. Four minute cartilaginous laminæ were found about the centre of the dorso-lumbar enlargement; and the opposite surfaces of the arachnoid were adherent at several points over the brachial enlargement, while part of the cord, especially the grey substance, was remarkably soft for about two inches. The remaining part of the cord below was somewhat softened.

When the disease occurs in the dorsal region between the two enlargements of the cord, the respiratory muscles, which are under the influence of the dorsal spinal nerves, obeying the laws of irritability, are frequently agitated by violent spasms, and the breathing is accomplished by short and painful efforts. If

the disease extend to either enlargement, the arms or legs may participate in the spasmodic movements. But, as the work of disorganization goes on, anæsthesia of the surface and paralysis of the muscles, above alluded to, follow in the train of symptoms;—abdominal respiration, disturbed circulation, embarrassed digestion, difficult defecation, inefficient micturition, and all the consequences of these respective functional disturbances, ensue.

The symptoms, when the injury is in the lumbar region, are not dissimilar to those of the dorsal region, except that the respiration is unaffected. When the lumbar region is the seat of the disease, the sound introduced into the bladder is more frequently covered with incrustations, and the patient also more commonly suffers from ulceration of the nates; but these symptoms, perhaps, result only in consequence of the patient surviving for a longer period than when the superior portions of the cord are affected. When the *myelitis* is limited to the lumbar enlargement of the spinal marrow, the convulsive movements occur at an early period of the disease, and cease *pari passu* with the disorganization of the cord. For a time the electro-muscular contractility is retained; but eventually it is almost always lost. The urine generally becomes alkaline, from retention by spasmodic contraction of the sphincters of the rectum and bladder; and *priapism* not unfrequently results as a reflex action from a distended bladder—a state which soon gives place to a negative condition, ushered in by reflex spasms of the legs during defecation and micturition (Meryon, l. c., p. 35).

In chronic affections of the cord the palsied limbs usually waste, and become atrophied.

In cases in which a limb has suffered from palsy, both of sensation and of motion, some singular phenomena of reflex action still remain. When a stimulus has been applied to the palsied limb, it occasions involuntary contraction of the muscles of that limb. Thus, when a feather is passed lightly over the hollow of the foot, as in tickling, convulsions occur in the limb, although the patient is quite unconscious that anything is touching his foot. These movements are quite independent of Volition, and vary in extent and force inversely with the degree of voluntary power possessed by the affected limb, being most forcible when the loss of voluntary power is most complete,

and diminishes gradually in extent and force as that power is increased. In some instances, by irritating one leg, movements were caused not only in that leg, but also in the other leg; and similar phenomena have been observed by Sir G. Blane and others in decapitated animals, showing that (consistent with the anatomical observations already referred to) a portion of the cord may furnish a supply of nervous energy after disease has interrupted its connection with the brain.

In all cases where the lesion of the cord is of such a nature as to intercept the transmission of the influence of the Will from the brain, convulsive movements are apt to occur in the legs, and to continue for a long time even after the arms have become completely paralyzed. These phenomena, says Dr. Meryon, are doubtless owing to the excitement of disease reflected from the spinal marrow to the motor nerves of the lower extremities. Similar involuntary movements may be produced artificially by tickling the soles of the feet, whose nervous connection with the brain is cut off by the destruction of a portion of the cord. The influence of the stimulus is transmitted to the spine by the incident nerves, and is reflected back by the motor nerves, thereby producing spasmodic contractions of the limb, (Budd in *Med.-Chir. Trans.*, vol. xxii.)

Diagnosis.—Diseases of the spinal cord and diseases of the brain are often followed by nearly similar symptoms; and, consequently, the one may be confounded with the other. But the history of the case, whether it has or has not been preceded by a fit of apoplexy or of epilepsy, will often enable us to determine the particular seat of the disorder. The antecedents and concomitant circumstances of every case must be carefully inquired into, and judged of upon their own merits. Myelitis is distinguished from lumbago, psoas abscess, and hip disease, by the absence of pain, and by the existence of palsy.

The characteristic symptoms of paralysis, as induced by destructive myelitis, are as follow (MERYON, l. c., p. 35):—(1.) Pain over that portion of the back which corresponds to the seat of inflammation. (2.) Lesions of sensation, giving rise to feelings of formication, creeping, prickling, tingling, heat, or cold, to numbness or complete anæsthesia. (3.) A gradual and progressive diminution of muscular power, distinguishing it from the paralysis which the French have denominated "*ataxie locomotrice progressive.*" (4.)

An equable degree of paralysis in all the muscles which are implicated; for as in health the nerve-force is distributed to whole groups of muscles in an equal degree, so likewise is it annulled when the nervous centre is disorganized. (5.) Convulsive and reflex movements of the paralyzed muscles. (6.) Spasm or paralysis of the rectum and bladder. (7.) Alkaline urine. And, finally, (8.) The loss of electro-muscular contractility.

Prognosis.—There seems no reason to doubt that, as many perfectly recover from superficial inflammatory lesions of the brain after fever, so also many slight inflammatory affections of the substance of the cord may subside, and the patient do well. Many cases, indeed, even when the bladder is slightly affected, recover. If, however, the disease be of more than a few weeks' continuance, the prognosis is always grave. Still, some few cases recover, the palsied limb becoming withered. But more commonly the disease runs on, and the patient at length dies after a long illness. When paralysis has once supervened, there is great reason to fear that the inflamed portion of the cord has passed into a state of disorganization, and that the disease is incurable; but the prognosis also eventually depends in some degree on the precise seat of the lesion. If it be in the cervical region, the immediate danger is greater than when the lesion is in the dorsal region; in this latter, again, the prognosis is more unfavourable than when lower portions of the spinal marrow are affected; and when the patient retains the command over the motions of the rectum and bladder, and the acid character of the urine is persistent, the case is still more hopeful (MERYON).

Causes.—The more common causes of disease of this portion of the nervous system are accidental violence, as blows or falls. Affections of the cord, however, sometimes occur idiopathically, and the constitutional causes producing it are exceedingly undetermined. They have been referred to a suppression of the menses in the female, and to the suppression of a hæmorrhoidal flux in the male, while others attribute them to sitting in damp or wet clothes, to onanism, or to venereal excesses, and prolonged exertion in the erect posture without active movement, inordinate muscular exertion, the action of cold, and the development of tubercle.

No age is exempt from *myelitis*, but it occurs more frequently from ten years old and upwards. It is most common, however,

in adult age, and more frequently attacks the male than the female sex.

Treatment.—In classing ramollissement of the cord with inflammation, it might appear necessarily to infer that the treatment should be strictly antiphlogistic. It is questionable, however, whether this mode of treatment is advantageous; and it may be laid down as a general rule that bleeding ought not to be had recourse to after palsy has occurred. It is then plainly improper; for, the nervous influence being intercepted, the powers of the lower part of the body are so reduced that gangrene will rapidly supervene—a tendency which loss of blood greatly increases. Previous to that symptom it may be admissible; and it may be stated that so long as the affected muscles are convulsed, rigid, and irritable, the use of antiphlogistics and counter-irritants is indicated; but when the means calculated to subdue excitation have failed to arrest the further progress of the disease, and paralysis supervenes, stimulants are the only remedies which have the power of restoring to functional activity those nerve-cells and conducting fibres which are not irretrievably destroyed (MERYON). The chances of saving the patient by other antiphlogistic remedies mainly rest on acting on the alimentary canal so as to produce three or four motions in the twenty-four hours, and thus create such a derivation as in some degree to relieve the parts. The greater number of patients that recover are restored by these means. The particular purgative is not perhaps important; but as the neutral salts act not only on the intestines, but also on the bladder, that class of remedies is generally preferred. At the same time that the bowels are kept free, the patient should be allowed a liberal supply of wine, from six to eight ounces daily, and should have animal food at least once a day.

With respect to local counter-irritants, as blisters, moxas, or setons, little favourable can be said, unless they are employed previous to paralysis, as the tendency to gangrene renders their application of doubtful utility. When had recourse to, however, it will be found better to apply them above the seat of the disease than immediately over it, the greater vitality of the superior parts giving more assurance of the disposition of the wounds to heal. Of all stimulant remedies, *electricity* and *strychnine* are the most potent and the best; and *secale cornutum* has been recommended as a remedy possessing the same power

as *strychnine* (BARBIER, PAYEN, MERYON). When there is no great pressure beyond that which simple congestion produces, nor actual disorganization of the spinal cord, the remedial power of *secale cornutum* is said to be very great. It seems especially to resuscitate the muscular contractility of the rectum and bladder, and pelvic viscera generally (GUERSANT, TROUSSEAU, BROWN-SÉQUARD, MERYON). The *ergot of rye* is best given in the form of *ethereal tincture, in doses of from ten to twenty drops twice or three times a day.* It does not relieve the reflex convulsions which are sometimes alleviated by *prussic acid, digitalis,* or *belladonna* (MERYON, l. c., p. 40), *chlorodyne* or *chloro-morphine.*

After the local pain in the back has been subdued by the regular and repeated application of two or three leeches to the painful part, followed by a large warm poultice over the whole length of the spine, and a belladonna plaster of equal length to follow it, or an occasional blister on each side of the spine, together with mild, warm purgatives, if necessary, Dr. Meryon has found no remedy so effectual as *strychnia, in the dose of one-twentieth of a grain, repeated more or less frequently (twice or three times a day) according to the evidence of its action.* It may be combined advantageously with *ipecacuanha* in cases where the intestinal mucus seems deficient.

The absence of pain and of spasmodic muscular contraction necessitates great caution in determining the precise moment when the spinal cord is likely to be benefited by the energetic excitement of *strychnia.* The internal administration of this remedy ought, therefore, to be always preceded by its external use, together with other stimulants in the form of embrocations over the spine, when the stage of excitation has been subdued.

Electricity, after the activity of inflammation has been subdued, is a therapeutic agent of great value; and the continuous current of galvanic electricity seems to be just as efficacious as the induction or intermittent current. But whether galvanism or electro-magnetism be employed, no high degree of tension is required for the restoration of muscular power; on the contrary, Dr. Meryon justly believes that the favourable course of many a case has been retarded by the employment of strong currents. Dr. Althaus, also, is in favour of weak currents.

In cases with a history of syphilis, and where there may be some reason to believe that hardening or induration of the

cord or its membranes has taken place, the *iodide of potassium* may relieve the early phenomena, and by the aid of *setons*, for reasons already given (vol. i., p. 769), the progress of the disease may be held in abeyance so long as the discharge is maintained from the *seton*.

When disorganization of the spinal cord has become an accomplished fact, the disease is incurable; but yet the exigencies of the patient, as Dr. Meryon justly observes, are not the less pressing on the careful attention of the physician, and in nothing more so than in the protection which is called for against bed-sores, which will sometimes occur in spite of the greatest care (*op. cit.*, p. 40).

PARALYSIS, OR PALSY.

LATIN EQ., *Paralysis;* FRENCH EQ., *Paralysie;* GERMAN EQ., *Paralyse* —Syn., *Lähmung;* ITALIAN EQ., *Paralisi.*

Definition.—*Palsy or paralysis are terms commonly restricted to affections where motion is lost, while the term* anæsthesia *implies a* palsy *of the nerves of sensation. Such various forms of palsy, or paralysis, are rather symptoms of a lesion than specific diseases.*

Pathology.—Palsy of a part is a very constant symptom of structural disease of the brain or of the spinal cord, but it occasionally occurs from a diseased state of a nerve-trunk itself. Palsy may affect a whole limb, or merely a part of one, and it is also limited to the muscles of certain regions. Palsy of a finger, a hand, an arm, or a leg, is an example of the first; palsy of the facial muscles of expression, from disease connected with the *portio dura* of the seventh pair, or facial nerve, is an example of the second.

The interesting clinical lectures of the late Dr. R. B. Todd describe the following conditions as giving rise to paralysis of motion:—(1.) Lesion of a nerve in some part of its course destroys its power of transmitting that force which is expressed by a contraction of the muscle into which the nerve is distributed. (2.) A lesion of some part of those central parts of the nervous system whence the nerve takes its origin, or with which it may be connected directly or indirectly. And, as a co-relative statement, it

may be written that whatever interferes materially with the conducting power of nerve-fibre, or the generating power of nerve-vesicle, will constitute a paralyzing lesion. Poisoning of the nervous matter will operate in this way. *Chloroform, ether, opium,* the poison of *lead* and of *mercury,* applied directly to the nerve-fibre of a living animal, suspends its power of transmitting the nervous force so long as the influence of the poison lasts. Poisons formed or retained in the living body operate in the same way, such as the retained *urinary* and *biliary* principles, as in Bright's disease, the poisons of *rheumatism, gout,* and probably also *syphilis* in some of its more severe tertiary effects. Whatever, in short, impairs the natural structure of the nerve-matter, such as *inflammation, atrophy, condensation, softening* (spinal, as in the form of *tabes dorsalis*), *solution of continuity,* either by simply cutting the trunk of a nerve, or by the deliquescence of the nerve-fibres, as a result of disease, such as *white softening,* a *sanguineous* (*spinal apoplexy*) or *serous effusion, pressure on a nerve or a nervous centre,* are causes which will produce more or less complete paralysis. Of this there is abundant proof—*e. g.*, the inclusion of a nerve in a ligature, compression of a nerve by a tumor, a depressed piece of bone in fracture of the skull, or an apoplectic clot on the exterior of the brain.

Four different conditions of the muscles are to be observed in cases of paralysis, namely,—(1.) A condition little different from that of health, but less firm, less excitable by the galvanic stimulus, when the paralyzing lesion is not of an irritative kind. (2.) Complete relaxation of the muscles; characterized by softness, imperfect nourishment, and rapid wasting—so rapid, that in a few days the size of the limb experiences a marked diminution. Such muscles scarcely, if at all, respond to the galvanic stimulus. (3.) Contraction of the muscles, with rigidity and wasting (the flexors being always more rigid than the extensors)—a condition which is due to a chronic shortening of the muscles themselves, and generally associated with a form of muscular atrophy. (4.) Nutrition not impaired, constant firmness and rigidity, incomplete paralysis, increased susceptibility to galvanic stimulus.

The practical inferences to be drawn from these conditions are of great value in treatment. Thus, early rigidity indicates local bleeding or counter-irritation, while complete relaxation is against antiphlogistic treatment.

The different forms of paralysis of common occurrence are due —(1.) To disease of the brain or spinal cord, in which form the muscles may be rigid or relaxed, the disease of the brain being the result of *apoplexy, minute hæmorrhages, softening, renal disease, induration*—the result of *syphilitic poison*,—the *epileptic* or *choreic* state; (2.) To pressure upon or injury to a nerve; (3.) To hysteria; (4.) To the influence of poisons, such as *lead, arsenic, mercury*, and some kinds of food-grains in a diseased state.

Typical forms of paralysis comprehend *Paralysis of the Insane*, or *General Paralysis; Local Paralysis*—e. g., *Facial Palsy*, and *Scrivener's Palsy; Hemiplegia; Paraplegia; Wasting Palsy*, or *Progressive Forms of Paralysis; Locomotor Ataxy; Paralysis from Blood-Poisons; Infantile Paralysis; Palsy from Lead Poisoning*, or other poisons in food or drink, or specific disease, such as *Diphtheritic Paralysis*.

FACIAL PARALYSIS.

Definition.—*Paralysis of the muscles of the face, usually confined to one side, but sometimes, though rarely, affecting both sides, and apt to be followed by contracture or tonic spasm of the muscles previously paralyzed* ("*Spasmodic Tic*" *of Marshall Hall*).

Pathology.—In previous editions of this text-book erroneous doctrines were stated regarding facial paralysis, in accepting and perpetuating the views of Dr. Todd, that "*the fifth nerve is more or less involved in the paralyzing lesion*," and in mixing up the phenomena of facial paralysis, depending on central or cerebral lesion, with facial paralysis due simply to lesion of the trunk or branches of the *portio dura*. I am indebted to my friend Dr. Sanders, of Edinburgh, for kindly directing my attention to this error, and for references to his important paper in the *Lancet* of Oct. 21st, 1865. From his papers on this subject, and the clinical lectures of the late Professor Trousseau on facial paralysis, the following account is given of this affection:—

Facial paralysis is due to one of ~~two~~ three causes, namely,—(1.) To a lesion simply of the trunk or branches of the *portio dura* nerve at some part of its course, and independent of cerebral disease. This form of facial paralysis is sometimes also known

as *Bell's paralysis*, or *peripheral facial hemiplegia.* (2.) Facial paralysis may be due to a cerebral lesion, in which case it is usually accompanied by hemiplegia of the limbs on the same side. This form of facial paralysis is known as *cerebral* or *centric facial hemiplegia.* (3.) A third form of facial paralysis is ascribed to reflex paralysis of the seventh, consequent on paralysis or lesion of the fifth pair. The first affection is that most frequently met with in practice; and although it is not a dangerous form of paralysis, it is one from which recovery is very slow, and in which prognosis, as to complete recovery of symmetry of the face, is uncertain. The second form is the more rare, and is always a very grave disease, and not usually recovered from. Both kinds of facial paralysis present many points of resemblance and of contrast, of great interest and importance in diagnosis; and the occurrence of paralysis from one of the causes mentioned by no means excludes the other, and therefore cases of both may exhibit extremely complex symptoms.

The phenomena of facial paralysis are confined to the "muscles of expression," including the *buccinator*, and do not involve the masticatory muscles (*masseter*, *temporal*, *pterygoid*) supplied by the fifth pair of nerves.

A description of the phenomena of *facial paralysis* must therefore have due regard to the course and distribution of the *seventh nerve.* The facial nerve, or *portio dura*, of the *seventh pair* is the motor nerve of the face. It emerges from the lateral column of the spinal cord, as that column passes under the *pons Varolii*, and enters the *internal auditory meatus.* At the bottom of this *meatus* it enters the *aqueduct of Fallopius*, and follows the windings of that canal to the lower surface of the skull—namely, to the *stylo-mastoid foramen*—by which it leaves the osseous canal. It is then continued forwards through the substance of the parotid gland, and separates in the gland, behind the ramus of the lower maxilla, into two primary divisions—the *tempero-facial* and the *cervico-facial*—from which numerous branches spread out over the side of the head, the face, and upper part of the neck, forming what is known as the "*pes anserinus.*" Within the temporal bone it is connected with the auditory nerve by filaments of union, and where it swells into its gangliform enlargement it is joined by the large superficial petrosal branch from the Vidian nerve, and also by the small superficial petrosal

nerve. Close to the *stylo-mastoid* foramen it gives off several small branches—namely, the posterior auricular, a branch from the *digastric muscle* and *stylo-hyoid*, and a twig to the *stylo-glossus*. In front of the mastoid process it divides into an *auricular* and an *occipital* portion, and is connected with the *great auricular nerve* of the cervical plexus. It also gives off branches to the *digastric* and *stylo-hyoid* muscles, joining the *glosso-pharyngeal* near the base of the skull, and the plexus of the *sympathetic nerve* on the external carotid artery. The main trunk of the facial then separates into two primary divisions, the larger of the two being the *tempero-facial*, which is directed forwards through the parotid gland. Its ramifications and connections with other nerves form a network over the side of the face, extending as high as the temple and as low as the mouth. Its branches are arranged in *temporal*, *malar*, and *infra-orbital* sets.* The smaller of the two primary divisions—the *cervico-facial*—is directed obliquely through the parotid gland towards the angle of the lower jaw, and gives branches to the face, below those of the *tempero-facial division*, and to the upper part of the neck.

* (*a.*) "The *temporal branches* ascend over the zygoma to the side of the head. Some end in the anterior muscle of the auricle and the integument of the temple, and communicate with the temporal branch of the upper maxillary nerve near the ear, as well as with (according to Meckel) the auriculo-temporal branch of the lower maxillary nerve. Other branches enter the *occipito frontalis*, the *orbicularis palpebrarum*, and the *corrugator supercilii muscles*, and join offsets from the *supra-orbital* branch of the ophthalmic nerve."

(*b.*) The *malar branches* cross the malar bone to reach the outer side of the orbit, and supply the orbicular muscle. Some filaments are distributed to both the upper and lower eyelids: those in the upper eyelid join filaments from the lachrymal and supra-orbital nerves; and those in the lower lid are connected with filaments from the upper maxillary nerve. Filaments from this part of the facial nerve communicate with the malar branch of the upper maxillary nerve.

(*c.*) The *infra-orbital branches*, of larger size than the other branches, are almost horizontal in direction, and are distributed between the orbit and mouth. They supply the *buccinator* and *orbicularis oris* muscles, *the elevators of the upper lip and angle of the mouth*, and likewise *the integument*. Numerous communications take place with *the fifth nerve*. Beneath the *elevator of the upper lip* these nerves are united in a plexus with the branches of the upper maxillary nerve; on the side of the nerve they communicate with the nasal, and at the inner angle of the orbit with the *infra-trochlear nerve*. The lower branches of this set are connected with those of the *cervico-facial* division. Near its commencement the *tempero-facial* division of the facial is connected with the *auriculo-temporal nerve* of the fifth, by one or two branches of considerable size which turn round the external carotid artery; and it gives some filaments to the *tragus* of the outer ear (Quain's *Anatomy*, edited by Drs. Sharpey, Thomson, and Clelland, p. 613).

Its branches are named the *buccal, supra-maxillary,* and *infra-maxillary.* In the gland this division of the facial is joined by filaments of the *great auricular nerve* of the cervical plexus, and offsets from it penetrate the substance of the gland.*

As the course, distribution, and connection of this nerve are most important to be remembered in acquiring a clear understanding of the phenomena of its paralysis, whether due to cerebral or peripheral causes, they are thus minutely given from the best text-book of anatomy (Quain's, the edition edited by Drs. Sharpey, Thomson, and Cleland).

One very important point to remember is that the *portio dura* of the seventh pair is the only motor nerve of the *buccinator muscle* for all its actions, whether of expression or of mastication; and that the fifth pair supplies it, not with motor, but with sensory fibres (MAYO, VOLKMANN, LONGET). *The buccinator muscle is interrupted in all its functions, whether of expression or of mastication, whenever the portio dura is paralyzed; it is unaffected, and all its actions are preserved, in motor paralysis of the* FIFTH PAIR (Sanders, *Lancet,* October 28, 1865, p. 478).

The threefold functions of the *portio dura* must also be recognized. Considered as a musculo-motor nerve, it contains within its common trunk the following sets of fibres serving different functions:—(1.) *Voluntary motor fibres,* by which the voluntary movements of the features are performed, and by which especially labial and buccal speech and mastication are accomplished; (2.) *Emotional fibres,* by which the features express the passions more or less involuntarily; (3.) *Reflex motor fibres,* which are involuntary, for the act of winking and for the movements of the nostrils in the acts of respiration. These different sets of fibres are

* (*a.*) The *buccal branches* are directed across the masseter muscle to the angle of the mouth; supplying the muscles (buccinators), they communicate with the *tempero-facial division,* and on the buccinator muscle join with the filaments of the *buccal branch* of the *lower maxillary nerve.*

(*b.*) The *supra-maxillary branch,* sometimes double, gives an offset over the side of the maxilla to the angle of the mouth, and is then directed inwards, beneath the depression of the angle of the mouth, to the muscles and integument between the lip and chin: it joins with the labial branch of the lower dental nerve.

(*c.*) The *infra-maxillary branches* perforate the deep cervical fascia, and, placed beneath the platysma muscle, form arches across the side of the neck as low as the hyoid bone. Some branches join the superficial cervical nerve beneath the platysma, others enter that muscle, and a few perforate it, to end in the integument (Quain's *Anatomy,* by Drs. Sharpey, Thomson, and Cleland, p. 615).

believed to derive their peculiar functions solely from the nature of their origin and place of central connection in the brain or *medulla oblongata*. In lesion, therefore, of the nerve trunk, in which all the fibres indiscriminately are equally liable to be affected, not only voluntary but emotional and also reflex motions will be suspended. But when the cause of the paralysis is cerebral, the origin or course of certain sets of fibres may alone be involved by the lesion, while others may entirely escape injury. The symptoms, therefore, of central paralysis will vary with the special seat of the central lesion. The voluntary and emotional actions (either or both), which have their origin in the cerebrum, will usually suffer; while the fibres for reflex action, which have their source in the *medulla oblongata*, may be expected to retain their power. The play of the features will be lost, and buccal and labial speech and mastication (so far as the buccinator muscle is concerned) impaired; but the natural position of semi-closure, and involuntary winking of the eyelids, will be preserved.

Looking, therefore, at the circuitous windings of the *portio dura*, its intricate distribution, and the various textures through which it passes, it can readily be understood how varied are its tendencies to be involved in disease, and even traumatic injury. Tumors, hæmorrhages, or other lesions, may involve the nerve within the cranium. While it traverses the circuitous windings of the *aqueduct of Fallopius* it may be injured and pressed upon by the results of necrosis or caries of the bone, or of suppuration or lesions of the fibrous sheath or periosteum; while lesions or tumors, involving the parotid gland, may injure the nerve and paralyze the parts it supplies.

Three forms of paralysis of the facial nerves ought to be discriminated in considering the diagnosis of central facial hemiplegia, namely,—*Voluntary Motor Paralysis*, *Emotional Paralysis*, and *Reflex Paralysis* (Sanders, *Lancet*, October 28, 1865, p. 479).

Symptoms and Causes.—The accession of facial paralysis (when peripheral) is usually sudden, and is generally discovered by the patient when he begins to eat. He feels something peculiar in the act of chewing, and has some difficulty in mastication. When the food gets between the paralyzed cheek and the teeth, the cheek is instinctively squeezed or pressed upon by the hand, in order to push the food between the teeth again. The difficulty of mastication only concerns the buccinator muscle, and not the

other muscles of mastication. There is no pain. The patient is soon and often abruptly told, by the first kind friend who happens to meet him, that his mouth is awry, and that it becomes considerably more so when he laughs. He then naturally wishes to see all this for himself; and on looking at his face in the looking-glass, he may verify the observation of his friend, and is then generally greatly frightened and alarmed by the discovery.

When the face remains at rest the paralyzed side looks slightly flatter, and more flaccid and pendulous, than the sound side. The eye of the paralyzed side is also more widely open than the eye on the sound side. When speaking, and still more when laughing is attempted, the angle of the mouth on the paralyzed side remains perfectly motionless, but on the sound side it is immediately drawn upwards and outwards. The eyelids, the cheek, and half the lip of the paralyzed side remaining thus motionless when efforts are made to contract the muscles, a singular and characteristic expression is given to the face. The eyelids remaining motionless on the paralyzed side, the patient is unable to shut the eye, but the globe of the eye itself moves perfectly in any direction at will, which shows that the motor muscles of the eye are not affected, and that the paralysis affects exclusively the *orbicularis palpebrarum* muscle, and does not involve the *levator palpebræ superioris*. Sight is unimpaired. The tongue is protruded with ease and regularity; lingual articulation is sufficient; but articulation of certain words is difficult, on account of the paralysis of the cheek. Sometimes the arch formed by the pillars of the fauces is larger on the paralyzed side than on the sound one, by the uvula inclining to the sound side. Cutaneous sensibility is unimpaired; and the patient may be in the best of health, the ailment being purely local—namely, paralysis of the facial muscles of expression on one side. There is an absence of all electric excitability of the paralyzed muscles supplied by the seventh pair.

One of the most common causes of *facial paralysis* is exposure to cold, especially to cold when sleeping in a draught or in the open air, or exposure to cold after being in a state of perspiration, or sitting in a railway or other carriage with the side of the face exposed to the wind. The influence of *rheumatism* is also conspicuous in many cases, the patient, being seized as suddenly as in *lumbago*, acknowledging a similar cause; residence in a

damp place, or other exposure to cold and wet, being sufficient to bring on the attack. The influence of mental emotion—a sudden fright or start—has been known to induce the paralysis. Of traumatic lesion the facial paralysis of new-born infants is not uncommon. It is generally due to the compression of the trunk of the facial nerves by the use of the forceps. If such compression has been severe or excessive, the injury may be permanent; otherwise, it is soon recovered from. Wounds of the *portio dura*, or fractures of the skull, involving lesion to the *aqueduct of Fallopius*, may also be followed by paralysis, and in all these instances the paralysis is sudden. When the facial nerve, during some part of its course, is interrupted in its functions by the secondary influence of advancing organic disease, the nerve becomes compressed gradually, and ultimately altered. In such cases the paralysis comes on slowly. In severe chronic inflammation of the internal ear, with destruction of the tympanum and ossicula, the petrous portion of the temporal bone becoming carious, facial paralysis is apt to supervene, and the lesions may be fatal.

The form of paralysis due to such causes is that known as *peripheral facial hemiplegia;* but the paralysis may acknowledge a *cerebral lesion* as its cause, such as cerebral hæmorrhages, lesions of the *pons Varolii*, implicating the fourth ventricle. In such cases the facial palsy is usually partial, affecting more especially the muscles of the mouth and cheek, leaving the closing movements of the eyelids unaffected. As a rule, also, the paralysis due to a cerebral lesion gives rise to a hemiplegia involving parts beyond the face, such as one or more limbs of the affected side. But there are also instances in which the paralysis due to a cerebral lesion (small cerebral hæmorrhages) has been exclusively limited to the face (GRAVES, DUPLAY). This is in keeping with other forms of hemiplegia (cerebral) in which the paralysis is localized; as when cerebral hæmorrhages or apoplectic-like seizures paralyze the tongue only, or an arm, or distort the features more or less, but generally combined with a hesitation in the movements of the leg, and of which the patient is unconscious (TROUSSEAU). The previous existence of peripheral paralysis in such cases may render superadded paralysis from a cerebral lesion very difficult to diagnose. When the cerebral lesion is limited to the *pons Varolii*, to slight injury to the fourth ventricle, the paralysis of the face which results has many of the characters of the peripheral or

Bell's paralysis, even to the absence of electric insensibility of the paralyzed muscles (VULPIAN, quoted by TROUSSEAU, who in the course of a very long practice never saw a case of the kind himself). Trousseau considers the most distinguishing characteristic of paralysis due to a cerebral lesion to be in the *absence* of complete paralysis of the *orbicularis palpebrarum*. "However complete hemiplegia of cerebral origin may be, I have never seen *complete paralysis of the orbicularis palpebrarum—the eye can always be closed;*" while in Bell's paralysis, the palsy of the *orbicularis palpebrarum* is never absent, and the eye cannot be completely closed (TROUSSEAU). This coincides with the experience of Dr. Sanders. There is, however, a slight modification to be acknowledged here, namely, that "although the patient with cerebral hemiplegia can close both eyes simultaneously, he cannot voluntarily close the eye on the same side as the paralysis while the other remains open" (BAZIRE). But it appears to me that this would only show *some extent* of paralysis if the patient were known to have been able to close either eye at will previous to his attack—a feat which many are unable to perform who are free from any paralysis. From the threefold functions of the *portio dura* already noticed, and the diverse origins of its several sets of fibres,* it will easily be understood how, in very limited and localized cerebral lesions, *all* the branches of the facial nerve may not be affected. The extent of apparent paralysis in cases of cerebral facial hemiplegia is not usually so great, and therefore not so alarming to the patient, as in cases of Bell's paralysis, where the trunk of the nerve only is affected. But the prognosis must be more unfavourable. In ordinary facial paralysis *of cerebral origin*, Dr. Sanders has always found that the muscles of expression, including the buccinator, were more or less affected, while the

* The seventh pair of nerves appear on each side, at the posterior margin of the pons, between the middle and inferior peduncles of the cerebellum, and nearly in a line with the place of attachment of the fifth nerve.

The *portio dura*, or facial nerve, placed a little nearer to the middle line than the *portio mollis*, may be traced to the *medulla oblongata*, between the *restiform* and *olivary fasciculi*, with both of which it is said to be connected. Some of its fibres are derived from the pons. Phillipeaux and Vulpian affirm that the fibres arise from the outer wall of the fourth ventricle, and that many of them decussate in its floor. Connected with the *portio dura*, and intermediate between it and the *portio mollis*, is a smaller white funiculus. The roots of this accessary or intermediate portion are connected deeply with the lateral column of the cord (Quain's *Anatomy*, by Drs. Sharpey, Thomson, and Clelland, p. 587).

action of the masseters, temporals, and pterygoids was unimpaired. The usual facial distortion was exhibited to a greater or less degree according to the amount of the paralysis, but it rarely approached the completeness usually seen in peripheral paralysis from lesion of the nerve trunk. With the exception of the slightness of implication of the *orbicularis palpebrarum* muscle, the phenomena of cerebral hemiplegia of the face are entirely similar to those of facial paralysis produced by lesion of the seventh nerve itself, and, as in the latter, are confined to the muscles of expression, including the buccinator, and do not involve the masticatory muscles (masseter, temporal, pterygoid) supplied by the *motor fifth.*

Another point of diagnosis is to be recognized in the behaviour of the paralyzed muscles under electric irritation. In facial paralysis of cerebral origin, the muscles respond *normally* to electric irritation; but if the paralysis is due to a lesion of the *portio dura,* their contractility is not at all, or scarcely at all, roused by an electric current (DUCHENNE, SANDERS, VULPIAN, TROUSSEAU). *The symptoms of cerebral facial paralysis* vary as the central lesion is more or less distant from the origin of the seventh pair. There is therefore much more variety in the expression of the face (according to the varying extent of the paralysis) than in cases of Bell's paralysis. The peculiar aspect of the face in *cerebral facial hemiplegia* is due to the want of symmetry between the two halves. The contraction of the muscles on each side is not co-ordinate. The sound cheek is wrinkled and shortened. The labial commissure on the sound side is drawn outwards and upwards, and is on a higher level than on the opposite side; the angle of the mouth on the paralyzed side is lower than its fellow; and if the paralysis is extreme, the commissure on the paralyzed side remains partially open, so that the saliva constantly escapes. The flaccid cheek is the result of paralysis of the buccinator. The nostril on the paralyzed side is more closed than on the sound side; but "in the great majority of cases of cerebral hemiplegia of the face, the orbicularis palpebraris is not materially affected; the act of winking and of voluntary closure of the eyes continues on the paralyzed as on the sound side, with the small exception that the voluntary closure is usually weaker on the palsied side.

These phenomena furnish the best diagnostic marks between *centric* and *peripheral* paralysis of the face; the hanging cheek,

with wide open, staring, unwinking eye, denotes lesion of the *portio dura;* the flaccid face, with the natural position and motion of the eyelids, is the sign of cerebral lesion, and indicates a more serious disease" (RECAMIER, TODD, SANDERS).

There is difficulty in the articulation of labial consonants and vowels. The tongue protrudes in the normal direction, and if its point seems to diverge from the median line to the paralyzed side, it only seems to do so in consequence of the commissure of the lip being drawn in the opposite direction—namely, away from the paralyzed side. But sometimes the tongue, too, is paralyzed and really deviates, and then it is drawn to the sound side, when the branches of the *portio-dura,* going to the *stylo-glossus* and the *genio glossus,* are implicated. Opinions differ greatly as to the implication of the tongue, the uvula, and the soft palate in cases of cerebral facial hemiplegia. Trousseau, Todd, Hasse, Longet, Romberg, Bidder, and Sanders, all refer to such cases. Dr. Sanders shows that the position of the uvula varies frequently, both in the natural and hemiplegic palate. The only reliable sign that the palate is involved in the lesion of the *portio dura* is the existence of a vertical relaxation, or lowering of the (paralyzed) corresponding half of the *velum palati,* with diminished height and curvature of the posterior palatine arch on the paralyzed side (SANDERS). Such cases indicate lesion before the geniculate ganglion in the Fallopian duct, and implicating the petrosal nerves. In both forms of facial paralysis the action of spitting is difficult, so also is whistling, as the patient cannot close the mouth nor inflate the cheek. Mastication is badly done, but only so far as the buccinator is concerned, because the food accumulates between the paralyzed cheek and the teeth. The hand is often seen to be held almost instinctively against the cheek to give it support, and to press the food to between the teeth for proper mastication, which is efficiently performed by the muscles of mastication (*temporals, masseters, pterygoids*).

In some cases of facial paralysis it has been noticed that hearing on the affected side becomes much more acute; and the taste is sometimes perverted, both indicating lesion high up within the bony canal traversed by the *portio dura* (TROUSSEAU, ROMBERG, BROWN-SÉQUARD, LANDOUZY, BAZIRE).

A peculiar and characteristic result of facial paralysis is the contracture and tonic spasms, or convulsions, of the muscles of the face which have been paralyzed—the "*spasmodic tic*" of

Marshall Hall. The simple contraction of the muscles is very common after Bell's paralysis, when it has lasted a long time and been extreme. It comes on after the affection appears to be cured, and after the symmetry of the face has been apparently restored. At first, and most usually, the contraction is partial, and is mixed up with some degree of paralysis, the contraction of the muscles not being effected at will. This contraction is common to all muscles which have been paralyzed and out of use for some time. The spasms are sometimes painful, and the contracted muscular masses are painful on pressure. Sometimes one muscle and sometimes another is thus affected. Sometimes it is the orbicular muscle of the eyelid, when the eye, instead of being more open, as it was when paralyzed, now looks smaller and is more closed. Such contraction is a most frequent termination of paralysis due to *rheumatism*. A rapid return of tonicity in a paralyzed muscle, the electro-muscular contractility of which had been completely abolished, is always a sign of approaching contraction (DUCHENNE).

Diagnosis of facial paralysis, differentially, is based on a knowledge of the circumstances under which the paralysis set in, the progress of its development, and the attending phenomena, bearing in mind the anatomical and physiological history of the *portio dura* already given. Sometimes the paralysis affects both sides; and one important test is given by Marshall Hall by which it may be known whether the cause of double facial paralysis is seated in the brain or in the course of the nerves. If the lesion is central (cerebral) the conducting power of the nerve trunks is retained for an indefinite period, so that by galvanizing the trunk and the principal branches of the facial nerves, all the paralyzed muscles supplied by the nerves are thrown into contraction, as if the muscles themselves were being galvanized; whilst, when the paralyzing lesion is *in the course of the nerves*, the nerves very easily lose their conducting power. If reflex movements be seen in the paralyzed muscles, the cause of the paralysis is assuredly a lesion of the nerve centres.

Prognosis.—Bell's form of peripheral facial paralysis generally gets well in time; and all the more rapidly that it sets in suddenly, and the patient young. From four to ten months is the ordinary duration of the affection; but there are instances in which the paralysis yields in twenty-four, fifteen, or even

twelve hours, but such cases are exceptional (TROUSSEAU). The prognosis in *central facial hemiplegia* is less hopeful; so also in *double facial hemiplegia;* because the cause indicates—from the symmetrical nature of the exciting lesion (generally periostitic)—some constitutional source as the origin of the mischief, *e.g.*, scrofulosis or syphilis.

Treatment.—Paralysis due to lesions which are destructive of the nerve are beyond medical aid. In cases suitable for treatment the agents used with most benefit are,—Blood-letting by leeches behind the ear of the affected side, or over the mastoid region. They ought to be applied repeatedly, especially if any pain exists on pressure in that region. Blisters, with dressings to keep them open, medicated by veratria or strychnia ($\frac{1}{25}$ to $\frac{1}{5}$ of a grain of *sulphate of strychnia* or of *veratria*), mixed with five or six times their weight of pounded sugar. Electrization in the form of Faradization by a Stöhrer's two-celled volta-electric machine; or in the form of an *interrupted galvanic current*, from a *continuous current* battery (as from a Muirhead's battery of fifteen cells), the number of cells being very gradually increased.

In using Faradization each facial muscle should be separately galvanized, instead of attempting to pass the current through the facial nerve. The muscles are thus more powerfully influenced, and they are more apt to regain *voluntary* contractility, at different periods, some muscles before others. At first the apparatus should be one capable of producing currents with very rapid intermissions; but when any muscles begin to *contract* the intermissions should be few, and the sittings at long intervals; otherwise contraction of the muscles is apt to increase and become incurable.

The interrupted galvanic current, from a continuous current battery, induces contractions when the circuit is closed and when it is opened, and more powerfully at the moment of closure. It is said to restore to palsied muscles the power of contracting under the influence of Faradization. When improvement follows the use of the interrupted galvanic current from a continuous battery, the number of the cells should be gradually increased as the muscles get less susceptible to their influence. One of the electrodes should be gently moved along the surface of the muscle, just as the brush is used in Faradization.

When contracture of muscles supervenes, they ought to be

stretched or pulled out mechanically; and to remedy contraction of the buccinator, Duchenne recommends the use of a small billiard ball, worn for a long time inside the cheek, to be replaced after a time by a larger one. The late Dr. Bazire gave favourable testimony to the value of this mechanical aid.

The daily action of the bowels ought to be carefully regulated by such medicines especially as keep the colon in functional activity. *Bichloride of mercury* (*corrosive sublimate*) in small doses, continued till the gums are slightly tender, is sometimes of service. In cases where rheumatism prevails or periostitic affections, small doses of *iodide of potassium*, persevered in for a lengthened period, are of service; with the frequent use of *phosphate of soda* as a daily morning aperient.

HEMIPLEGIA.

LATIN EQ., *Hemiplegia;* FRENCH EQ., *Hémiplégie;* GERMAN EQ., *Hemiplegie*—SYN., *Halbseitige Lähmung;* ITALIAN EQ., *Emiplegia.*

Definition.—*A form of paralysis affecting one lateral half of the body.*

Pathology.—It is that form of palsy to which the name of "*paralytic stroke*" is commonly applied. Either half of the body may be affected; and the parts which are actually involved are generally the upper and lower extremities, the muscles of mastication, and the muscles of the tongue on one side. The paralysis may be either complete or incomplete as regards motor power. Consciousness may or may not be perfectly retained; and whether it is so or not, the patient, when seized, falls to the ground, because the power of maintaining his equilibrium is destroyed by the failure of the antagonizing muscles of one-half of the body. The affected arm and leg lie as if lifeless on the side, all power of motion in them being destroyed. Stimulation, however, of the extremities of the sentient nerves, by slight titillation with the fingers, sometimes gives rise to active movements. The combined effect of such stimulation and the resulting movements is to cause considerable pain. These excited motions, to which the name of "*reflex actions*" has been given, occur almost exclusively in the lower extremities. Other involuntary movements of the paralyzed limbs occur simultaneously with the action of yawning, or result from emotions of surprise, joy, pleasure, grief, laughter, crying.

When the *fifth* nerve is implicated in the hemiplegia, the proper masticatory movements are unequal on the two sides, in consequence of paralysis of the temporal, masseter, and pterygoid of the affected side. There is a want of force in the masseter muscles of the paralyzed side; and there is therefore apt to be lateral displacement or obliquity of the inferior maxilla, either when at rest or during mastication. The mesial line between the lower incisors is thus also apt not to correspond to that in the upper jaw.

Sometimes the *third* nerve may be paralyzed, in which case the upper eyelid drops, and there is inability to raise it, combined with outward squint and dilated pupil.

The protrusion of the tongue is also characteristic in hemiplegia. It is pushed out towards the side affected, and on being retracted it is drawn towards the healthy side. Imperfect articulation exists in *hemiplegia*, and results from the palsy of the *ninth* and *fifth nerve;* and where the power of speech is wholly lost, or utterance is limited to monosyllables, the sign is not favourable, but denotes, with other symptoms, extensive lesion of the brain, superficial as well as deep. When deglutition is impaired, serious and extensive lesion of the brain, connected with the *vagus* or *glosso-pharyngeal nerve*, is denoted.

The lesions which give rise to hemiplegia are of the following kinds:—(1.) *Hemiplegia* typical of diseased brain depends on a softening clot, abscess, tumors, or exudation, involving or compressing some considerable portion of the centre of volition, such as the *corpus striatum* or *optic thalamus*, or in the immediate vicinity of those parts. Unless pressure be produced, or the fibres otherwise interfered with, paralysis does not result. The centre of volition "reaches from the *corpora striata* in the brain down the entire length of the anterior horns of grey matter of the spinal cord, and includes the *locus niger* in the *crus cerebri*, and much of the vesicular matter of the *mesocephalon* and of the *medulla oblongata*." Disease of any part of this range of structure is capable of producing paralysis; and the palsy is on the side of the body opposite the lesion. (2.) The intracranial portion of this range exercises the greatest and most extended influence in the production of voluntary movements, and the most extended and complete paralysis takes place from disease of the *intracranial portion*. (3.) In cases of cerebral disease it must be observed and remem-

bered that the intracranial portion of the centre of volition for the left side of the body is situated on the right side, and that for the right side is situated on the left side of the cranium, while the *intraspinal* portions maintain relatively their respective sides. These two portions are connected by the oblique fibres coming from the anterior pyramidal column of the *medulla oblongata*, which (crossing from right to left) decussate with similar fibres proceeding from left to right. (4.) Exudations which are the result of inflammatory or other diseased state of the membranes of the brain, which, as they increase and cause pressure on the surface, transmit the effects of pressure downwards to the *corpus striatum* and *optic thalamus*, and thus cause paralysis. (5.) Morbid states which affect or destroy fibres of deeper-seated parts, such as the *crura cerebri*, or of the *cerebellum* in its crura (because a connection exists between the hemispheres of the cerebellum and the fibres of the pyramids in the *pons Varolii*), cause paralysis. (6.) The slow accession of paralysis following symptoms of irritation indicates a gradual morbid change, such as from exudations slowly taking place. (7.) An important feature in paralysis is due to the condition of the muscles, as to whether they are rigid or relaxed. (8.) Rigidity, whether supervening or occurring simultaneously with the paralysis, indicates irritative disease within the cranium. (9.) In cases where the rigid condition of the muscles does not come on till after a long period of paralysis, and after the muscles are perhaps wasted from atrophy, such a condition indicates loss of substance in the brain, and that the cicatrix is undergoing contraction. (10.) *Hemiplegia* typical of spinal disease, where the palsy is on the same side of the body as the disease, is caused by a lesion involving a lateral half of the spinal cord *below* the decussation of the pyramids. (11.) In *hemiplegia* typical of epilepsy the lesion is transient, the palsy in general remaining only a few hours, or at most a few days, after the epileptic attack. It is termed *Epileptic Hemiplegia*. (12.) The *hemiplegia* associated with chorea occurs during acute attacks of that disease, and is termed *Choreic Hemiplegia*. (13.) The *hemiplegia* associated with hysteria is also of transient endurance. (14.) There is a form of *hemiplegia* where the morbid phenomena seem to spread from the periphery to the central parts.

In all these forms of hemiplegia the paralysis is a paralysis of motion more or less complete. In general, however, sensation is

also more or less impaired. In estimating the condition of the sentient functions, the same method is to be adopted which Weber devised in comparing the sensibility of the surface of the skin in different parts of the body. It consists in ascertaining how near the sharp points of a pair of compasses may be approximated, and yet be distinctly felt as two points by the patient.

The special lesions of the brain causing hemiplegia are—(1.) Obstruction of a principal cerebral artery by a plug of fibrin detached from an excrescence on one of the aortic or other valves of the heart,—the result of a former endocarditis (KIRKES and VIRCHOW). (2.) A coagulum formed in an artery, resulting from some altered nutrition of its wall, and connected in general with a rheumatic or other morbid state of the blood. (3.) A softened state of the brain, such as the condition known as white softening, which follows the retardation and diminution of cerebral circulation by diseased arteries, or by the complete stoppage of an artery by a plug. (4.) Apoplexy, induration, or tumors—*e. g.*, tubercle or cancer in the parts indicated above.

Treatment.—The object to be aimed at in the early treatment of hemiplegia is to keep down the frequency and force of the heart's action. For this purpose strict maintenance of the horizontal position is necessary; and when Consciousness exists, let the Mind be kept tranquil by every means. Remove any local impediment to the easy flow of blood, and let the head be slightly raised, sufficient to prevent gravitation favouring the escape of blood from the ruptured vessels, but not so as to create any impediment to the flow, and so embarrass the action of the heart Let the bowels be cleared out, so that no irritation from them may operate injuriously on the brain. In so doing, enemata ought to be employed; and failing these, castor oil or calomel, with compound jalap powder, may effect an efficient evacuation.

With regard to blood-letting, there are three objects to be attained,—(1.) To diminish an undue amount of blood to the head; (2.) To check hæmorrhage, or to prevent it; and (3.) To quiet the action of the heart (TODD).

The circumstances under which its use is inadmissible are thus defined by Dr. Todd:—If the patient be cold and collapsed; if the heart's action be feeble and intermittent; if there be an anæmic state; if the patient be of advanced age; if there is evidence of extensive disease of the arterial system or of the heart; or, lastly,

if it can be ascertained that already a large amount of hæmorrhage has taken place into the brain;—these, singly or conjointly, are reasons why bleeding *ought* NOT *to be resorted to.* If none of these objections exist, it is to be considered whether any of the indications noticed require to be fulfilled, and whether they can be fulfilled by a local or general blood-letting. Modern investigations show that the brain is not generally in a hyperæmic state; so that it is chiefly to check or to prevent hæmorrhage that bleeding is to be resorted to in such cases. The sudden or rapid abstraction of a moderate quantity of blood, either from the arm or temple, or by skilful cupping, may check hæmorrhage, but the quantity taken should be small; and so, likewise, the quantity drawn ought to be moderate if it is desired merely to lessen the frequency and force of the heart's action. "Generally," writes this distinguished physician, "I have come to the conclusion that, in cases of white softening, you are less likely to err by omitting than by adopting the practice." The rigidity of the muscles, which comes on very early, and which indicates an inflammatory process going on round the clot, is to be combated by urinary and alvine evacuants, and by counter-irritation. It is not desirable to interfere in the *later* forms of muscular rigidity. With regard to the use of expedients for promoting the restoration of the paralyzed limbs to their normal conditions, Dr. Todd writes that he knows of nothing which is of more decided benefit than a regulated system of exercise—active when the patient is capable of it, passive when he is not.

Any congestion of the spinal cord apt to supervene on cerebral hemiplegia must be diminished. The patient should not lie on his back, but, if possible, flat on his belly, the arms and legs being encased in flannel, and placed at a lower level than the spine. A hot douche may also be applied to the spine, the water falling from a height of at least *four* or *five* feet, through a tube *three-quarters* of an inch or *one inch* in diameter; and its temperature should be between 98° and 100° Fahr. The applications should be continued two or three minutes, and continued daily for some time. *Dry cupping* over various parts of the spine may also be of service, and so also may blisters, moxas, cauteries (BROWN-SÉQUARD). The most useful internal remedies are those which tend to lessen congestion in the cord, namely, *belladonna* and *ergot of rye.* The dose of *ergot* in powder is at first *three grains twice a day,* and

gradually *the dose may be increased till it reaches six grains twice a day.* *Belladonna* may be applied to the spine in the form of a plaster *four inches wide and six or seven inches long;* and if no amelioration of the symptoms follows in a few weeks, the *extract of belladonna* may be given in doses of *a quarter or a third of a grain twice daily;* and if after six or eight weeks of this treatment no improvement is observed, Dr. Brown-Séquard recommends that *iodide of potassium* in doses of *five* or *six grains twice a day* may be given in addition to the *belladonna.* If meningitis is supposed to exist along with chronic myelitis, then the *iodide of potassium* should be given from the very commencement, along with the *belladonna,* or with *secale cornutum,* as recommended by Dr. Meryon. Spermatorrhœa may be relieved by pressure applied over the region of the prostate (THOMAS and MERYON).

To prevent atrophy of paralyzed limbs, the application of galvanic currents and the use of the flesh brush are recommended; and when œdema of the limbs exists, a warm bath to the part every night is of service. The bowels must be kept open, and if anodynes are required, opium should be avoided, and hyoscyamus, conium, or Indian hemp should be used instead. Dr. Brown-Séquard recommends hyoscyamus. Iodide of potassium ought to be taken before food in the morning, and an hour before dinner, so as to avoid its presumed decomposition by the gastric juice.

The nutrition of the spinal cord ought to be improved by the daily use of the cold douche; and sea bathing may be of service. If symptoms of irritation do not exist, *belladonna* is not to be given: it is only in cases of congestion that it may be useful in diminishing paralysis. And the same rule applies to *ergot of rye.* *Strychnine* increases the amount of blood in the spinal cord. It may be employed in paralysis only when there is no sign of irritation, and ought to be avoided when there are signs of congestion or irritation (BROWN-SÉQUARD).

PARAPLEGIA.

LATIN EQ., *Paraplegia;* FRENCH EQ., *Paraplégie;* GERMAN EQ., *Paraplegie;* ITALIAN EQ., *Paraplegia.*

Definition.—*A form of paralysis affecting the lower half of the body, in which both legs, and perhaps, also, some of the muscles of the bladder and rectum, are paralyzed.*

Pathology.—Of this kind of paralysis there are at least two forms, which differ as to their mode of origin—namely, (A.) *Reflex Paraplegia;* (B.) *Paraplegia due to myelitis in some one of its numerous forms.*

(A.) *Reflex Paraplegia.*—Physicians and surgeons at different times have met with and recorded cases of paralysis which the amount of disease present in the nervous centre or its covering after death would not account for; which blood-poisoning would not account for; but which were found to be uniformly associated with injuries or diseases of parts or organs remote, and not directly contiguous to the spinal marrow. Such cases were assumed to be cases of "Reflex Paralysis;" and they have now been long recognized and described by various observers. Mr. Stanley, in 1833, published a paper in *The Medico-Chirurgical Transactions* "On Irritation of the Spinal Cord and its Nerves in connection with Disease of the Kidneys." He there records cases of paraplegia in which no morbid appearances were detected in the cerebro-spinal axis, but where inflammation of the bladder or kidneys, or gonorrhœa, had existed for some time. Similar cases of "Urinary Paraplegia" have been recorded by Romberg, Graves, Rayer, and several other writers. Mr. Spencer Wells recorded in *The Medical Times and Gazette* cases of this kind, in 1857, having made them the basis of an excellent clinical lecture at the Grosvenor School of Medicine. Dr. Brown-Séquard, in a series of four lectures, published in 1861, relates the grounds of diagnosis and the principles of treatment of these various forms of paraplegia. Lastly, Dr. Meryon describes seven forms of paralysis as due to reflex action, namely—(1.) *Emotional paralysis.* A case of this kind is described by Dr. Meryon, in his work already referred to, p. 172. Dr. Wiblin, of Southampton, in *The Lancet* of August 11, 1860, records a case of so-called emotional paralysis. The subject of that case died in October, 1864, and I had an opportunity of removing the brain and cord in connection, which I sent to Mr. Lockhart Clarke for his inspection. From the *post-mortem* appearances, I regarded the case as one of *chronic meningitis,* associated with disease of the blood-vessels. In this view Mr. Lockhart Clarke concurred, and mentioned that he found cysts also in different parts of the brain—two or three small ones in the white substance round the *corpus dentatum cerebelli.* One of these contained a fluid that was perfectly milky, and

appeared under the microscope in the form of granular globules of oil, about twice the size of pus-globules, with a multitude of oily molecules. Several cysts were found in the *cerebrum;* and the *corpus quadratum* of the right side was hollowed out into a large cyst. Such lesions remove this case from the class of so-called "*Emotional paralysis.*" (2.) Pregnancy is apt to induce such *reflex paraplegia,* or sometimes *hemiplegia* or *amaurosis* (CHURCHILL). (3.) *Neurolytic paralysis,* in which, from no adequate cause, the functions of the cord seem suspended for a time, associated generally with exposure to cold and wet. (4.) Paralysis from the *irritation of worms* in the intestinal canal (DAVAINE, MERYON). (5.) Paralysis from the *irritation of teething* in children. (6.) *Urinary Paralysis.* (7.) Paralysis from *uterine disease,* as from *dysmenorrhœa, metritis.*

The views entertained by these several writers regarding the existence, especially, of a "Reflex Paraplegia" have been called in question by many able pathologists, and chiefly by Drs. Gull, Nasse, and Valentiner; but the facts on which the belief in "Reflex Paraplegia" rests, and which show that "a paralysis of the lower limbs may be caused by some alteration in the *periphery,* or the trunk of various sensitive nerves," may be shortly stated as follows:—(1.) A very rapid cure of the paraplegia follows the removal or cure of the primary disease which involved the peripheric sensitive nerves. Such rapid cures do not result in cases of paraplegia when the spinal cord or its membranes are primarily diseased. (2.) There are certain characteristics of *reflex paralysis* which tend to show how distinct it is from the cases of paralysis depending on organic alteration of the nervous centres. These characteristics are,—(*a.*) An outside excitation connected with some morbidly sensitive surface or nerve, and which exists for some time before the paralysis comes on—*e. g., stricture of the urethra, gonorrhœa, disease of the kidney, prolapse of the womb,* and the like; (*b.*) Variations in the degree of this excitation are followed by variations in the paralysis; (*c.*) The cure of the paralysis follows the subsidence of the primary disease.

Cases of "reflex paralysis" are also well known to occur in all the upper parts of the body—*e. g.,* paralysis of the optic nerve is sometimes due to injury of the frontal nerve; paralysis of the auditory nerve is sometimes due to neuralgia of the face; local palsy, as of the eye, the neck, the trunk, the bladder, or the rec-

tum, is sometimes due to teething, worms, or other sources of excitement of the sensitive nerves, terminating in the mucous membranes or the skin; and the cure of amaurosis after the expulsion of worms is by no means uncommon.

Cases of paraplegia following diseases of the womb, and cured after the cure of this disease, are recorded by Romberg, Hunt, Wolf, Brown-Séquard, and others. Cases of paraplegia due to a disease of the urethra are on record by Graves, Wells, and others. Cases of paralysis consequent on inflammation of the bladder—gonorrhœal cystitis—have been related by Rayer and Brown-Séquard. Cases of reflex paralysis are also due to diseases of the prostate or kidney, to enteritis, dysentery, diphtheria, and affections of the lungs and pleura. The paralysis which attends teething has been known to increase and decrease as the molars are cut. Irritation of the nerves of the skin, generally following cold and wet, has been known to induce reflex paraplegia (*neurolytic paralysis* of Handfield Jones); and so also has disease of the knee-joint. In all these instances the paralysis follows the primary disease which is the cause of the local "peripheric excitation." Increase or decrease of this excitation and of the attendant paralysis, according as the cause persists or is suppressed, is among the recognized phenomena of such cases.

There are at least two ways by which the reflex action from the outside irritation may induce paraplegia, namely—First, *the reflex contraction of blood-vessels.* Brown-Séquard has the great merit of having actually demonstrated this. We know that the blood-vessels can contract with energy on the application of a stimulus or excitant, sometimes to the extent of a real and prolonged spasm; and we know that the nervous system is amply supplied with blood-vessels. In *three* different places—namely, (1.) *In the spinal cord;* (2.) *In the motor nerves;* (3.) *In the muscles*—such a contraction of blood-vessels is found to cause "paraplegia." In the vessels of the pia mater of the spinal cord, Dr. Brown-Séquard has seen how the vessels contract when a ligature was applied on the *hilus* of the kidney, or when a similar operation was performed on the blood-vessels and nerves of the *supra-renal* capsules.

Generally, in those cases, the contraction is much more evident on the side of the cord corresponding to the side of the irritated nerve. These demonstrations also coincide with other physiologi-

cal evidence. More than half a century ago, Comhaire extirpated the kidney from living dogs, with the effect of instantly producing paralytic weakness of the hind leg of the side operated on. Brown-Séquard found the same result on extirpating either a kidney or a supra-renal capsule. It is, therefore, quite legitimate to conclude that irritations of these parts from disease may produce a paraplegia, by causing contractions of the blood-vessels of the cord similar to those which took place in these experiments.

There are other reasons which show that such paralysis is due to reflex action and probable contraction of blood-vessels—namely, the fact familiar to surgeons, that chills, tremors, and even convulsions, are often connected with catheterism. Another kind of proof is that of a negative kind, which shows that "the spinal cord may have its functions impaired, and even lost, and that suddenly, without any anatomical lesion." This is proven by the *post-mortem* examination of cases dying after symptoms of reflex paraplegia. Such cases are related by Stanley, Rayer, Cruveilhier, Chomel, Drs. Stokes and Graves, of Dublin, and Dr. Gull.

The present position of our knowledge of the structure and functions of the spinal cord hardly entitles us to assert, without careful microscopic examination, whether alteration of the cord does or does not exist in cases of *reflex paralysis*. Of all these cases, only in that of Dr. Gull was any microscopic examination made; and it is not impossible, but it is very probable, that a functional lesion, established even in a reflex way, may go on to organic mischief in the end.

Paralysis due to *myelitis* having been already noticed in connection with that disease, it may be useful to contrast here, in a tabular form, the leading phenomena of the two diseases, as given by Dr. Brown-Séquard in his admirable lectures *On Paralysis of the Lower Extremities;* and which, to some extent, are subscribed to by Dr. Edward Meryon.

PARAPLEGIA DUE TO

(A.) URINARY REFLEX IRRITATION.	(B.) MYELITIS.
1. *Preceded* by an affection of bladder, kidneys, or prostate.	1. Usually no disease of the urinary organs, except as a consequence of the paralysis.
2. Usually lower limbs alone paralyzed.	2. Usually other parts paralyzed besides the lower limbs.

PARAPLEGIA DUE TO

(A.) URINARY REFLEX IRRITATION.	(B.) MYELITIS.
3. No gradual extension of the paralysis upwards.	3. Most frequently a gradual extension of the paralysis upwards.
4. The paralysis is usually incomplete —an extreme debility or weakness of the limbs rather than paralysis.	4. Very frequently the paralysis is complete.
5. Some muscles more paralyzed than others.	5. The degree of paralysis is the same in the various muscles of the lower limbs.
6. Reflex power neither much increased nor completely lost.	6. Reflex power often lost, or sometimes much increased.
7. Bladder and rectum rarely paralyzed, or at least only slightly so; *sphincter ani* weak.	7. Bladder and rectum usually paralyzed completely, or nearly so.
8. Spasms in paralyzed muscles extremely rare.	8. Always spasms, or at least twitchings.
9. Very rarely pains in the spine, either spontaneously or on the application of pressure, percussion, or a hot moist sponge, or ice.	9. Always some degree of pain, existing spontaneously or caused by external excitations.
10. No feeling of pain or constriction round the abdomen or the chest.	10. Usually a feeling as if a cord were tied tightly round the body at the upper limit of the paralysis.
11. No formication, pricking, nor disagreeable sensations of cold or heat.	11. Always formications, or pricking, or both, and very often sensations of heat or cold.
12. Anæsthesia rare; the tactile sensibility being but slightly if at all impaired, but the muscular sense may be almost lost.	12. Anæsthesia very frequent, and always at least numbness.
13. Usually obstinate gastric derangement.	13. Gastric digestion good, unless the myelitis has extended high up in the cord.
14. Variations in the degree of the paralysis corresponding with changes in the primary disease.	14. Ameliorations very rare, and not following changes in the condition of the urinary organs.
15. Urine is usually acid, unless the urinary organs are diseased.	15. Urine almost always alkaline.
16. Cure of the paralysis frequently and rapidly obtained, or taking place spontaneously, after a notable amelioration or cure of the urinary affection.	16. Frequently a slow and gradual progress towards a fatal issue; very rarely a complete cure.
17. *Usually* muscles do not become atrophied, and temperature is little lowered.	17. Atrophy of the muscles of the paralyzed parts.

It is necessary, therefore, to look for some primary disease to account for *reflex paraplegia*, believing at the same time that

such primary disease may ultimately establish a myelitis, while a diagnosis of *reflex paraplegia* is mainly based on a contrast of the phenomena which attend the various forms of paraplegia due to other causes.

In addition to the characters in the table, there are some symptoms peculiar and almost pathognomonic of forms of paralysis due to other local lesions—*e. g.*, meningitis of the spinal cord induces rigid spasms of the muscles of the back; intense pain on motion of lower limbs or of the spine; spontaneous acute pains that radiate from the spine to the lower extremities (similitude to rheumatism); frequency of cramps; and pressure on the cord by a tumor or diseased bone. They may and often do produce a myelitis. Pressure causes a feeling of tightness and pseudo-neuralgic pains. A tumor in the grey matter of the cord is attended with anæsthesia from the very first, which may reach a higher degree than the power of motion; and reflex power below the lesion becomes then extremely exalted. In hæmorrhage into the cord there is pain, then sudden paralysis, and often convulsions.

Treatment.—In cases of *reflex paralysis* means must be taken—1st. To diminish the external irritation which causes the paralysis; 2d. To improve the nutrition of the spinal cord; 3d. To prevent the ill effects of rest on the paralyzed nerves and muscles.

In cases of disease of the urethra or prostate, *an injection of a solution of one grain of the extract of belladonna, in twenty drops of laudanum, is to be made into the urethra, and the injection should be retained for half an hour, or even an hour, after which some emollient decoction should be used, such as lintseed tea, to wash out the passage.* Every two or three days this operation should be repeated. If the bladder be diseased, Dr. Brown-Séquard advises a solution of *one grain of the extract of belladonna,* in twenty drops of laudanum, to be used as an injection, after a complete emission of urine. Injections of carbolic acid are also of use in counteracting decomposition of urine and epithelium in the bladder. If the prostate is enlarged, a suppository ought to be put at times into the rectum. One of the best suppositories for this purpose is composed of the following ingredients, namely:—*White sugar, white soap, and gum-arabic in powder, of each three grains; opium, in powder, a grain and a half; or belladonna extract, one grain; or both combined. These being mixed together, the mass is to be formed into a*

conical shape, and being dipped in melted wax, is ready to be introduced when required into the rectum (SIMPSON).

When the irritation causing reflex paraplegia starts from the vagina or uterus, a pill of half a grain of the extract of belladonna, with a grain of opium, surrounded by a piece of cotton wool, is to be introduced into the vagina, and made to surround the neck of the womb. By means of a thread it may be withdrawn so soon as the pain ceases or diminishes (TROUSSEAU, BROWN-SÉQUARD).

Belladonna ought not to be used constantly. *Opium*, combined with *strychnia*, is of greater use in reflex paralysis; and of all remedies, *strychnia* is best suited for promoting the second indication, which points to increasing the nutrition of the spinal cord. The dose combined with opium must be a small one—namely, *one-fortieth* to *one-thirtieth of a grain daily;* and when used alone, its dose may be *one-twentieth of a grain;* and when employed together with *belladonna*, its dose must be still larger.

In cases where no congestion nor inflammation of the spinal cord exists, *strychnia* ought to be persistently employed; but its use ought to be suspended at once whenever it produces spasms, or even numbness of the feet in getting out of bed in the morning (BROWN-SÉQUARD). *Sulphur baths* are also productive of great benefit.

The third indication—namely, to prevent the ill effects of rest on the paralyzed nerves and muscles—is best met by the employment of galvanism and shampooing of the paralyzed limbs. Two or three applications, of ten minutes each, in a week, are sufficient; but of all things it is necessary that the primary disease (causing by its persistent existence the reflex paralysis) should be cured or mitigated.

There are yet four forms of so-called paralysis to be noticed, characterized by a tendency to progress from bad to worse. These are—(1.) Progressive Muscular Atrophy, or Wasting Palsy; (2.) Progressive Locomotor Ataxy; (3.) Glosso-laryngeal Paralysis; (4.) Progressive Paralysis of the Insane.

PROGRESSIVE MUSCULAR ATROPHY.

LATIN EQ., *Atrophia ingravescens;* FRENCH EQ., *Atrophie progressive;* GERMAN EQ., *Progressive Atrophie;* ITALIAN EQ., *Atrofia progressiva.*

Definition.—*A peculiar wasting of muscles, with atrophy of their*

substance, and lesion in the anterior roots of the nerves of the spinal cord, and paralysis.

Pathology and Symptoms.—Idiopathic paraplegia is doubtful; yet it is certain that cases do occur, concerning which it is not easy to say, during the life of the patient, nor even after a *post-mortem* examination, what is the cause of the paralysis. For example, the cases of so-called "wasting palsy," the *paralysie musculaire atrophique* of Cruveilhier, are not yet made out to be a really specific disease independent of the state of the spinal cord. When spinal cords are examined in the way they have hitherto been examined, most of them are pronounced healthy. Of the numerous cases of "*wasting palsy*" collected together by Dr. Roberts, in thirteen only was the nervous system examined, out of one hundred and five in all, and of these thirteen, four of them had disease of the cord. Obscure structural changes in the grey substance of the cord, or even only in the grey substance of the ganglia on the posterior roots of the nerves, may affect the nutrition of parts to which they are subservient, without interfering with the function of motion or sensation in the first instance.

A very interesting case of local atrophy of muscles, and local paralysis of the specially affected groups, is related in Beale's *Archives of Medicine* for October, 1861, which would no doubt have been set down as a case of "wasting palsy" *independent of disease of the cord*, if that organ had not been sent to Mr. Lockhart Clarke, and carefully examined by him. He found, and demonstrated, that lesions existed in it which occurred in small isolated spots, sufficient to account for the limitation of the disease to particular muscles. If, therefore, we are ever to arrive at accurate and available results, both as regards physiology and pathology, our mode of examining the spinal cord must be more searching and exact than heretofore. There is no royal road to the removal of the spinal cord. Time, patience, and great caution are necessary to avoid injuring the soft parts, so that, when hardened perfectly, entire sections may be got for examination under the microscope. If this plan were more systematically adopted, it would undoubtedly open up a new field of pathological and physiological study, furnishing results which no experiment in vivisection could possibly reach, if the history of the case was complete. Numerous cases of wasting of the muscles of one or more limbs, independent of any well-defined cause, have been

from time to time observed, and are recorded in various publications; and we are indebted to Dr. William Roberts, of Manchester, for the first systematic treatise on the subject, in 1858. Such cases have hitherto been looked upon as *extraordinary* or *anomalous cases*, and were described as instances of "creeping palsy," "partial" or "local palsy," or "anomalous hemiplegia." In France it has been described by the name of "*atrophie musculaire progressive*," or "*paralysie graduelle du movement par atrophie musculaire*" (DUCHENNE, ARAN, CRUVEILHIER), corresponding to the third form of progressive paralysis described by Meryon—namely, from "granular degeneration of the muscles, and where no disease or lesion is found in the nervous centres.

In 1851 Dr. E. Meryon gave an account of a gentleman's family in which three boys were the subjects of general muscular degeneration. His observations were original, and are published in the *thirty-fifth* volume of the *Medico-Chirurgical Transactions*, p. 73. Several cases have been described since Dr. Roberts called attention to the subject; and the more closely and carefully the spinal cord has been examined after death by competent observers, the more surely has it been found diseased. In all the cases observed the muscles affected are those under the control of the Will; hence the course of the disease is easily followed, either by the changes produced in the external form of the parts, the absorption of masses of muscles, the displacement of bones, the abnormal position of joints from loss of their muscular supports, or by the failure of certain movements which contribute to outward expression or inward function, such as facial physiognomy, deglutition, vocalization, or respiration—all of which depend on the operation of striped muscles under the influence of the Will. When the disease affects the muscles of the limbs the *disappearance* of the *muscles* causes very notable changes of conformation. The rounded contour gives place to a lean and withered aspect, the bony levers stand out in unaccustomed distinctness, so that the limb has the appearance of a skeleton clothed in skin (ROBERTS). As a general rule, when one limb is attacked, its fellow on the opposite side shares its fate; when the disease is unilateral, the right side is more likely to be its seat than the left; but the disease seems to be extremely capricious and uncertain in its line of attack, scarcely two examples being exactly alike in the combination of muscles implicated, or the

relative degree in which they suffer. But when the malady affects the shoulder it scarcely ever fails to include the upper arm; so also the fore-arm and hand are generally associated in the disease. In the upper limbs the morbid action seems to radiate from two centres:—one in the hand, from which the fore-arm is invaded; and the other in the shoulder, from which are reached the muscles of the upper arm, and those which brace the shoulder-blade to the ribs. When the hand and arm are destroyed, the evil does not then pass up the arm, but starts away to the shoulder, or to the opposite hand. In the same way, when the shoulder is first attacked, the disease does not descend along the upper and fore-arm to the hand, but, passing over the elbow, it begins afresh in the ball of the thumb, and from that focus spreads up the limb; so that the parts latest reached are those about the elbow, especially the masses that take their rise from the humeral condyles.

The invasion of wasting palsy is usually slow and insidious. It creeps on unawares; and the victim of its attack only becomes cognizant of the disease when he notices some marked failure in certain muscular powers. The tailor notices that he cannot hold his needle; the shoemaker wonders that he cannot thrust his awl; the mason's hammer has grown too heavy for his strength; the gentleman feels an awkwardness in handling his pen, in pulling out his pocket-handkerchief, or in putting on his hat (ROBERTS). On comparing the weakened member with its fellow, it is seen to be wasted, and the failure of power increases; the lifting power is reduced to nothing; the grasp is gone; and at last palsy becomes complete. In the majority of cases the disease commences in the upper extremities; and if the disease commences in the legs, it is probable that the atrophy will spread to the trunk. In more than *one-third* of the cases noticed by Dr. Roberts the hand was the member originally seized; and the exact spot nearly always the ball of the thumb; and the right hand more often than the left. Next to the hands, one or other shoulder is the favourite starting point.

Prognosis.—The disease runs its course with great slowness. Some cases complete their history in six or eight months, others linger on through many years. Recovery, permanent arrest of the palsy, or death, are the various terminations of the disease. The mean duration of the cases ending in recovery has been

one year and two months; of those ending in permanent arrest of the palsy, the mean duration of the cases has been *two years and three months;* of those terminating fatally, the mean duration was *five years and two months.* The longest duration of a case ending in recovery has been *two and a half years,* and the shortest period *eight months.* The longest case ending in arrest continued active for *seven years,* and the shortest for *four months.* Fatal cases have not been known to terminate under *twelve months,* while one lingered for *twenty-three years,* another for *eight years,* and some beyond *four years* (ROBERTS).

In those cases which terminate by permanent arrest the wasting of the muscles ceases, and the limb continues for an indefinite period in its maimed condition, neither amending nor deteriorating. The muscles atrophied are not regenerated, but remain *in statu quo;* and those which are not completely atrophied continue to exercise their feeble powers under the influence of the Will, but they never regain their former bulk or vigour. After lying torpid for years, the malady may awaken to new and more violent activity (ARAN, VIRCHOW); and temporary lulls in the progress of the atrophy are common enough, but they seldom last long (ROBERTS). The disease is invariably fatal when it invades the trunk.

Morbid Anatomy.—The lesions are to be sought in the nervo-muscular system; and when death occurs in this and other forms of progressive paralysis, it is usually by some disorder of the respiratory apparatus, inducing *bronchitis, broncho-pneumonia, laryngitis,* or simply *apnœa,* from paralysis of respiratory muscles. Lesion of the muscles is constant, and nearly identical in all the cases. They are wasted away, some slightly, some profoundly, even to annihilation, their place being marked merely by origins and insertions, composed of more or less condensed connective tissue. Where muscular tissue is visible, it has lost the red hue of health, appearing of a pale red colour, like the flesh of a frog or fish. The degree of change into fat is various; in some no fat can be found, in others it is abundant, probably as an after-degeneration. Under the microscope the stripped elementary muscular fibres are seen to be completely destroyed, the sarcous element being diffused, and in many places converted into oil-globules and granular matter, whilst the sarcolemma, or tunic of the elementary fibre, was broken down and destroyed (Meryon, *Med.-Chir. Trans.,*

vol. xxxv. p. 76). The striæ may be distinct, and between them grey or brilliantly shining molecules are to be seen; and where no striæ exist, long cylinders may be seen in place of the primitive fibres (GALLIET).

With regard to the nervous system, the *central organs*, the *spinal roots of the nerves*, and the *peripheral distribution*, have each engaged attention. In thirteen only of the 105 cases recorded by Roberts was the spinal cord examined; and in *four* instances it was found diseased. It is unnecessary to repeat again here how imperfect our information is on this point. Of the lesions recorded, a summary may be stated as follows:—(1.) While the spinal centre was considered sound, the anterior roots and peripheral distribution of the muscular nerves were extensively diseased. (2.) Inflammatory softening of the cord accompanied fatty degeneration and destruction of the anterior roots; and in one instance the peripheral muscular branches were destroyed. (3.) Amyloid degeneration of the cord, confined to the posterior median columns, has been observed in one instance, associated with granular degeneration of peripheral muscular branches, but with preservation of the anterior roots. (4.) In the cases examined by Mr. Lockhart Clarke, in the regions of the spinal cord which supplied the wasted muscles, numerous patches of transparent granular degeneration were found, especially in the grey substance, and generally around or in the vicinity of blood-vessels. The nerve-cells were shrunken and atrophic, and they contained an unusual number of coarse pigment-granules, while *corpora amylacea* were abundant around the central canal of the cord.

Causes.—With regard to the cause of this form of palsy, it is difficult to say whether it begins in the nerves associated with the muscles, and secondarily affects the spinal marrow connected therewith, in the manner referred to by Turck and Graves, and to which the term "creeping palsy" is applied; or whether (as Lockhart Clarke's observations tend to show) the lesion of the spinal cord is the primary lesion. In all cases the question to determine is whether or not the atrophy of the muscle is subsequent to the paralysis. If so, there are good reasons for believing that the wasting of the muscular tissue is an immediate or direct effect of the lesions in the cord; and the paralysis is generally too rapid to be accounted for by mere

inactivity of the paralyzed muscles. Dr. Meryon believes that only in the last form the disease commences in the muscles. Dr. Roberts, on the other hand, contends that the muscles are the parts essentially diseased, in the first instance, in the cases of "wasting palsy" which he has described. A blight (?) seems to wither the muscles, of the nature of a degeneration. He believes the disease to be of constitutional origin; and the evidence of this rests upon the facts that it is transmissible from parent to offspring, and that in its march it exhibits a bilateral symmetry.

The disease has been observed to follow cases of fever and sunstroke, severe falls, and blows on the back of the head or spine; and it is well to observe in all cases whether or not the brain has received any accidental shock; and it is probable that several distinct diseases have been described under the name of "wasting palsy" (W. T. GAIRDNER).

Symptoms.—*Loss of power* is a chief phenomenon, and it corresponds to the grade of the atrophy of the muscle; and it is only in extreme cases that any part is reduced to absolute immobility. *Muscular vibrations*, consisting of little convulsive twitchings or quiverings of individual muscular bundles, are also early phenomena. They do not impart any movement to the entire muscle, but parts of the muscle seem to spring beneath the skin in quick momentary tremors, undulating over the surface of the muscle. Tactile sensation retains its delicacy in the skin over the affected muscles. Pain is by far the most common of the nervous symptoms. It is present in about half the cases recorded. It is generally transient, and is usually marked at the commencement of the disease. The advance of the malady has, in one case at least, been attended by an almost childish degree of helplessness, and a most pitiable state of mental irritability and hypochondriac depression (W. T. GAIRDNER, ADAMSON, BELL, GULL, DAY). *Unusual sensitiveness* to low temperature is occasionally a prominent and very annoying symptom. As a rule, the general health does not seem impaired. Intelligence is clear, Judgment firm, and the Emotions under control, and all the organic functions appear to be performed with regularity.

Prognosis.—The *progressive forms of paralysis* are the most intractable in the domain of physic, and the gravity of the prognosis depends upon the disease confining itself to the extremities and the muscles thereto relating, or extending to

the trunk and face. The signs of extension to the face are a diminished mobility of the lips, a slur in the articulation of words, frequent sighing, and fibrillary muscular tremors on different parts of the chest, abdomen, or face. If the disease has been hereditary, there is every fear that it will be fatal; and so also if the lower limbs are first attacked.

Treatment of *wasting palsy*, as laid down by Dr. Roberts, appears to be chiefly hygienic—namely, *methodical exercise* and *douche baths*, or *cold mineral baths;* so also *thermal* or *sulphur baths*, and *galvanism*. *Frictions*, with stimulating liniments (such as camphor liniment), are also favourably spoken of. *Localized electricity*, in the form known as "Faradization," has been highly spoken of (DUCHENNE, GROSS, MEYER, ROBERTS, ALTHAUS). "Faradization" consists in the employment of the electricity of the induced or secondary current in the helix round the magnet, originally discovered by Faraday. It ought to be practised at least three times a week, *for from five to ten minutes each time*, and continued at least a month before it is given up, if negative results are only obtained. Every muscle ought to be Faradized in a special manner, according as it has suffered more or less in its electric contractility and nutrition. The power of the current ought never to be strong. When the sensibility of the muscle returns, the intensity of the current may be diminished. Its application should never be protracted beyond ten or fifteen minutes at the most, one minute, on an average, being allowed to each muscle, or distributed over several at a time.

Volta-electric machines are made for medical purposes by Messrs. Stöhrer, of Dresden. Magneto-electric machines are to be got from most of our philosophical instrument makers. The apparatus for applying a continuous current, as modified by Dr. Althaus, is to be obtained of Messrs. Legendre & Morin, of Paris.

If, on the other hand, it turns out, as the searching examinations of Mr. Lockhart Clarke would tend to show, that these forms of progressive paralysis or "wasting palsy" are always associated with disease of the spinal cord, the efforts of treatment should, in the first instance, be directed to that part of the cord corresponding to the connections of the nerves with the site of lesions—the line of treatment to be pursued being determined by the general symptoms.

PROGRESSIVE LOCOMOTOR ATAXY—Syn., PROGRESSIVE MOTORIAL ASYNERGIA.*

French Eq., *Ataxie locomotrice progressive;* German Eq., *Rüchenmarks Lahmung, Tabes Dorsalis, Progressive spinal paralysie, Degenerative Atrophie der spinalen hinterstränge.*

Definition.—*A peculiar form of apparent paralysis, characterized by unsteady and disorderly muscular movements, but with muscular power entire, and more or less progressive loss of the faculty of co-ordinating power (voluntary and instinctive). There is sometimes temporary diplopia, with unequal contraction of the pupils. The course of the disease is slowly progressive; and the anatomical lesion is generally a degeneration of the posterior columns and horns of the spinal cord and posterior roots of the spinal nerves, and sometimes with peripheral structure-change in the cranial nerves; and chiefly the second, third, and sixth pairs, in cases where the sight is affected.*

Pathology.—The disease is one of middle life; most common in the prime of life, between thirty-five and fifty years of age; it is very rare in youth or old age. It is also more frequent, in a very large proportion, in males than females.

The essential anatomical lesions are found in the posterior columns of the spinal cord, the posterior roots of the spinal nerves, the peripheral extremities of the cranial nerves, and, exceptionally, in those of the extremities. The membranes of the cord are generally unaffected or merely congested—sometimes thickened posteriorly by exudations adherent to each other and to the posterior surface of the cord. The degeneration and atrophy of the posterior columns of the cord cause the cord to seem flat in its antero-posterior diameter. The posterior median fissure is effaced or marked only by a whitish line. The degeneration consists of an atrophy with disintegration of the nerve fibres (gelatiniform degeneration of Cruveilhier and Virchow), with proliferation of the connective tissue, giving to the columns a grey transparent aspect. *Corpora amylacea* are found imbedded in the connective tissue. The blood-vessels which traverse the columns are loaded on their external coats, and surrounded to a

* From *α*, privative, and *συνεργος*, joint-work, co-operation (Bazire); and the Editor of the American edition of this book suggests *motorial* in place of *locomotor*.

variable depth with oil globules and granules of various sizes. The *dorso-lumbar* region of the cord is the most constant site of lesion, which may involve one or two inches, to nearly the whole extent; and may extend in depth to the surface of the lateral columns, and occasionally even along the edges of the anterior columns. Localized areas of some widely-spread degeneration have even affected the extremities of the posterior cornua and deeper parts of the grey substance (Lockhart Clarke, *Lancet*, June 10, 1865). The posterior nerve-roots, both within the cord and after leaving its substance, are similarly involved in the degeneration, and the general progress of the disease in the cord seems to indicate a central commencement advancing to the periphery; but in the cerebrum the phenomena indicate an opposite course—namely, affection of the peripheral distribution of the first, second, third, fourth, fifth, sixth, and seventh nerve, travelling to the centres. From the retina and optic nerve it has advanced as far as the *corpora geniculata*, and even to the *corpora quadrigimina*. The eighth pair seems the only cranial nerve that has not yet been implicated. The condition of the sympathetic is unknown.

These anatomical lesions (so exactly limited to the posterior columns of the cord, and the roots issuing therefrom) by no means account for all the symptoms which are clinically recognized as distinctive of this disease. The nature of the peculiarly characteristic gait is sometimes referred for explanation to the loss of the "*muscular sense*" of Bell, or the loss of "sense of muscular activity" of Gerdy. The inco-ordination is essentially a reflex disorder; and the lesions involve the co-ordinating centres (posterior column of spinal cord) of certain muscular acts, such as walking and standing. Some of the phenomena of the disease suggest involvement of the sympathetic—*e. g.*, the vesical phenomena, also the phenomena of irregular contractions of the pupils, and their becoming dilated during paroxysms of pain, or when the legs or arms were pricked or pinched, with local perspiration increased in some parts only of the skin, *e. g.*, forehead, palms of hands, and fingers* (Bazire).

* Dilatation of the pupil is known to result from disease of the *third* cranial nerve or its roots; section or lesion of the sympathetic in the cervical portion; intravertebral section of the two upper dorsal nerves, *followed by irritation of the peripheral ends of the cut roots.*

The disease, then, is a peculiar one of the nervous system, commencing insidiously with evidence of disorder of some of the *cranial* nerves, perversion of sensibility in different parts of the body, ultimately giving place to inco-ordination of motion—always associated with degeneration of the posterior columns of the spinal cord and posterior nerve-roots, but without loss of muscular power or impairment of the intellect. The connecting links between the initial disorders of the cranial nerves (advancing centrically) and the lesions of the spinal cord (progressing peripherally) have not yet been made out.

In addition to these characteristic *post-mortem* lésions, there is evidence during life, both at the commencement and throughout the course of the disease, of localized congestions, expressed by rachalgia and spinal tenderness.

Symptoms.—The outset of the disease is insidious and slow. Pains, generally ascribed to rheumatism or neuralgia, first attract attention, particularly in damp weather. These pains may be fixed and aching, or darting, piercing, and transitory. Affections of the *second, third, fifth,* and *sixth* pairs of cranial nerves, sometimes with headache, giving rise to imperfect or double vision, strabismus, or contractions of the pupil, or dilatations, or deafness, are also insidious phenomena which may attract early notice. These several phenomena generally appear at different times and singly, although sometimes several together; and, after persisting for some time, may pass away. Weakness in some of the limbs may supervene, but no actual paralysis. Another distressing harbinger of the disease is incontinence of urine, associated with spermatorrhœa during the night, with a great proclivity to sexual congress, which is no mere impotent desire, but results in effective sexual intercourse. But after a period (of perhaps two years) the emissions on sexual intercourse become hasty, and a gradual loss of sexual desire and the power of erection supervenes. The bladder becomes irritable. Constipation is occasional when the pains are severe, and it always aggravates them. Transient tickling sensations prevail in different parts of the body, such as the lips, nose, cheeks, forehead, with occasional numbness of the feet and arms, and the peculiar feelings of so-called "pins and needles, as if they were asleep." After another long interval (say of two more years), undue fatigue after walking is experienced: the legs give way under the weight of the body,

and there is a sensation as if the patient walked on a spring-board and could not keep his balance. These feelings may disappear and return; and eventually cutaneous hyperæsthesia or neuralgia of the skin (one side of the scrotum, testicle, buttock, or external part of thigh), always unilateral, supervenes.

Motorial inco-ordination may not come on till after a period of several years (four or five) of suffering from such nervous symptoms. The pains then occur very irregularly, and last from a few hours to many days. At times they dart from limb to limb, or from one part of a limb to another; or, fixing on a small circumscribed spot, they give a boring, gnawing, or tearing sensation. The pains leave behind them a stiffness and soreness of the part. There may be atrophy of the optic disc, with contracted pupil; cutaneous anæsthesia of the soles of the feet, legs, forearms, and lips; and tactile sensibility seems slowly conducted to the sensory centre. Reflex movements are not excited by tickling the soles of the feet. A painful feeling of constriction, as if by a tight band, is sometimes experienced round the body; and the sensation of "bearing down," in the perineum and rectum, with constipation, prevails. The bladder imperfectly empties itself, and cannot retain the urine after experiencing the desire to void it. The desire to pass it is frequent and imperative, especially during the night. Some degree of paralysis of the bladder is indicated by diminished force in the strain of urine—the jet is not well arched, and drops dribble away after the act is believed to be over. The urine sometimes passes involuntarily. Sexual desire is eventually abolished. The gait is characteristic. The steps are quick, short, and jerking. The leg and foot are well lifted from the ground, but they are thrown spasmodically and forcibly forward, the whole limb being extended. In bringing the foot down, the heel strikes the ground first. As the disease progresses, the limbs are thrown involuntarily to the right or left without purpose, and without the power of restraining in any way their irregular movements. In walking, the eyes are kept fixed on the legs; and a stick is used, over the handle of which a handkerchief may be placed to increase the surface of contact required by the numbness of the hand. The muscular force remains good, so that efforts to bend or extend a limb against the will can be resisted with strength. Involuntary jerkings of the limbs in bed

prevent sleep. It is especially at starting that the patient has the greatest difficulty in maintaining equilibrium.

When muscular inco-ordination of the upper extremities supervenes, the fingers become numb, and objects are handled with increasing clumsiness. The clothes cannot be buttoned, nor small things removed from the pockets by the fingers. If the patient is set on his legs with his eyes closed, and his feet close together, although he has muscular power to stand, yet he cannot preserve his body from falling, or guide himself in taking a few steps in the dark or with his eyes shut. He has no idea of the position of his lower extremities except from sight.

The prolonged course of the disease is characterized by frequent natural pauses in its progress, sometimes lasting for a long time, before its onward progress is resumed—a point to be borne in mind in the treatment of the disease.

Electro-muscular sensibility is generally lessened; and during the early stages of the disease there is neither paralysis of muscles, nor wasting of their substance, nor defective *nutrition* of the limbs. The patient may be strong enough to bear and to carry considerable weight; so that there is not muscular weakness, far less paralysis, in the ordinary sense of the term. The seeming paralysis is entirely due to the peculiar deficiency in the power of co-ordinating voluntary movements. The duration of the disease ranges from a few months to thirty years, with a mean duration of *seven* years in 119 cases whose progress has been observed (Dr. Clymer).

Diagnosis.—In the early stage of the disease the differential diagnosis is between intracranial lesion and the peripheric lesions of the cranial nerves, which characterize the commencement of progressive locomotor ataxy. Here the ophthalmoscope becomes of use. In the amaurosis of intracranial disease there is always evidence of recent or past *neuritis* of the optic disc; but such is not the case in this disease (H. Jackson). Care must also be taken not to confound the disease with progressive muscular atrophy, already noticed p. 487.

Prognosis is decidedly unfavourable. The lesions may remain stationary for long periods, but recovery never takes place, and eventually the disease progresses onwards to death. Of forty-three fatal cases, the immediate cause of death in *six* were lesions of the brain or spinal marrow, with softening, hæmorrhage, and progressive muscular atrophy. Three died of acute inflammation of the

urinary organs, and four from extensive sloughs over the sacrum. Thirty died during the course of intercurrent diseases, not directly connected with the motorial asynergia—namely, thirteen of pulmonary consumption, three from typhoid fever, four from pneumonia, others from pericarditis and dysentery.

Causes.—The only positive determining causes seem to be prolonged exposure to damp, cold, depression of the nervous system from insufficient diet; mental exhaustion, trouble, and anxiety; venereal excesses, especially onanism. If there be a hereditary history of various nervous diseases, *motorial asymergia* may be connected with those diseases, and ascribed to a common origin.

Treatment.—The intercurrent localized congestions in the region of the spinal cord point to topical blood-letting by cupping or leeches, cautiously employed, and perhaps frequently repeated; with persistent counter-irritation over the spine (by *blisters, moxæ, actual cautery,* or *ice*), particularly over those parts where there is tenderness or pain. *Phosphorus,* in the form of *phosphates of metals* and *salts,* of *diluted phosphoric acid,* as a drink in the daily allowance of water, of *phosphate of soda* as an aperient, may be given with benefit. *Nitro-muriatic acid* as a tonic, and *cod-liver oil* as a dietetic agent, may also be of use. Flannel should be worn next the skin, and chills from cold and damp carefully avoided by the use of a chamois leather close-fitting jacket over the flannel, and reaching from the height of the clavicles as low as the folds of the *nates* behind. The diet ought to be of the most nutritious materials which the patient can digest. *Cannabis Indica* and *belladonna* give the greatest relief to the pains.

So long as there is active local hyperæmia the use of electricity is hurtful. Faradization may be of use in restoring, to some extent, sensibility to the skin, where local cutaneous anæsthesia has prevailed—after which patients seem to walk better for a time; but when used at, all electricity ought only to be employed during the pauses in the course of the disease, and then with great caution, in the form of a constant current rather than the induced current, or Faradization.

GLOSSO-LARYNGEAL PARALYSIS—Syn., GLOSSO-PHARYNGEAL PARALYSIS.

Definition.—*Diminution and subsequent loss of the motor power of the tongue, soft palate, and lips, associated with structural*

changes in the roots of the motor nerves which supply the affected muscles. The disease progresses always rapidly to a fatal termination.

Pathology.—Concurrent paralysis of the tongue, palate, and vocal cords, together with the associated muscular movements of deglutition, is more or less capable of explanation by the close anatomical connection between the muscles supplied by the *vagus*, the *spinal accessory*, and the *lingual* nerves. The *lower* rootlets of the spinal accessory nerve (forming the external branch) arise, in common with the anterior roots of the spinal nerves in the cervical and brachial region, from the anterior grey substance of the spinal cord; while the *upper* rootlets (forming the internal branch) have a totally different and a double origin—one from a special nucleus continuous with that of the pneumogastric behind the central canal, and the other from the proper nucleus of the hypoglossal, in front of the canal. Some of the fibres of the hypoglossal seem to take their origin from the spinal accessory nucleus (LOCKHART CLARKE, *Beale's Archiv.*, No. 3).

The constant anatomical lesion in the paralysis under consideration is *atrophy of the motor roots of these nerves, sometimes extending to the anterior roots of several of the upper spinal nerves, attended with more or less paralysis of limbs and incipient muscular atrophy.*

Glosso-pharyngeal paralysis and progressive muscular atrophy are found to be attended with the same nerve-lesions—namely, atrophy of motor roots of nerves, cranial as well as spinal; and in all patients suffering at first from glosso-pharyngeal paralysis there is a tendency for the paralysis to become general (TROUSSEAU). Gradual disappearance of the nerve-elements, and proliferation of connective-tissue from the neurilemma, are the characteristic anatomical lesions at the roots of the affected nerves.

Symptoms.—The earliest and most noticeable are those which are due to palsy of the muscles of the tongue, the soft palate, and the lips, those of the larynx and pharynx becoming implicated at a later period. The origin, progress, and termination of the disease are so characteristic that, according to Trousseau, there is no other identical affection in the whole range of nosology. Embarrassment of speech first attracts attention. The tongue seems less supple, and the utterance becomes more and more thick. The food is apt to lodge between the teeth and the cheek, the cause of this

being different from that which obtains in Bell's paralysis. In such facial paralysis it is due to paralysis of the buccinator muscle; here it is due to the circumstance that the tongue being more or less paralytic, awkward, and incapable at the tip, the patient is obliged to use his fingers to remove the food from between the teeth and the cheek, and so replace it on the tongue. Pronunciation of certain words is made through the nose. The vowels *o* and *u* cannot be properly sounded, on account of the deficient contractility of the *orbicularis oris* muscle. Saliva is apt to dribble from the lips and corners of the mouth. The paralysis continuing to progress, the tongue at last lies motionless in the hollow of the mouth, behind the lower teeth. Its apex and base are equally motionless, and not a word can be articulated. The shape of the tongue is also altered. It has sunk down in the centre, presenting a hollow in the middle line, with its edges raised. The soft palate also droops, and the tip of the uvula rests upon the tongue, and is generally callous or insensible to irritants. The first stage of deglutition thus becomes impossible. The morsels are swallowed by holding the head backwards, and facilitating their gliding down by fluids. Sometimes only a small quantity of the food gets into the œsophagus, the remainder being propelled upwards through the mouth and nostrils, and sometimes small portions of food will find their way into the larynx, causing great distress. The appetite remaining good, but swallowing being thus impossible, constant hunger aggravates the distress (TROUSSEAU).

Excessive weakness of the respiratory movements is soon superadded to these already serious symptoms. The walls of the chest and the diaphragm scarcely move. If the patient be asked to blow out a candle, he cannot do it. The flame will be scarcely agitated by his utmost efforts to blow upon it. Coughing is equally inefficient; so that if catarrh should supervene, there is great difficulty in expelling the increased secretion of mucus. Asphyxia is thus apt to prove fatal. The heart's action becomes abnormally rapid, but fever does not exist. The body temperature tends to sink below the normal, and betokens, with the other phenomena, the imperfect oxygenation of the blood. General debility now makes rapid progress, and the patient rather inclines to remain in bed, sitting up with his head supported on pillows, inclined to one side sufficiently to allow of the saliva flowing

away which he is now unable to swallow. Sleep is disturbed by paroxysms of suffocation, and death is apt to ensue suddenly by cessation of the heart's action, unaccompanied by pain or noise (TROUSSEAU).

Diagnosis.—From the general paralysis of the insane it is distinguished by the intellect of the patient remaining perfectly clear; and the gravity of the complaint impresses itself on the mind. The convulsive movements of the lips are also absent. In cases of hemiplegia, the palsy is unilateral. In double facial paralysis—a rare affection—the movements of the tongue are free, and deglutition remains efficient, all the muscles of the face are paralyzed, so that expression is as blank and fixed as marble, the patient laughs or cries as if from behind a mask (DUCHENNE); but in glosso-laryngeal paralysis the lower part of the face alone remains motionless.

Prognosis is unfavourable. The disease has always proved fatal. Its progress is generally rapid and continuous. From three to six months it may not seem to make so rapid a progress as it does later; but as soon as deglutition becomes imperfect, death is rapid.

Treatment.—Faradization is of doubtful efficacy at the commencement, but gives relief at the later periods, by temporarily restoring function to the affected muscles, to the lessening of the trouble of deglutition, and by exciting the respiratory acts.

APHASIA.

Definition.—*Inability to communicate thoughts, ideas, or names of things either by words or by writing, the intellect being more or less perfect otherwise, and the organs of phonation free of paralysis. The affection may be associated with unilateral paralysis, or spasms, and be subsequent to apoplexy. There may be disease of the third left frontal convolution, or in the left anterior lobe of the brain, near to this convolution, and various other lesions of no constant kind.*

Pathology.—Every shade of deficiency or inability characteristic of this affection is to be met with, from temporary loss of memory of certain words, the names of common objects, and their misuse in conversation, up to persistent and complete inability to give expression by words, writing, signs, or gestures, to thoughts or

ideas. The non-expression of the names of things, or the substitution of wrong ones, is among the most common forms of this inability. "Hand me the —— to stir the ——." "Poker" and "fire" are the words which are incapable of being spoken. "Give me my ——; you know," pointing to his head. "Your hat?" "Yes, my hat." Many other examples are given by Trousseau. The substitution of one word for another is another form of this affection—*e. g.*, "boots" for "head." Forgetting your own name, or the name of the person you go to visit, is another form. In another series of cases there is a sudden loss of the general faculty of speech, without paralysis or incapacity of thought. In a third set of cases there is unilateral palsy or unilateral spasms; and sometimes it occurs after an attack of apoplexy, or after an attack of severe typhus or typhoid fever.

In some cases, however, the thought or idea which leads to verbal expression, as Dr. Gairdner shows, is not absent, so that the faculty remains of communicating by the usual written signs.

The several theories of localization of the brain lesion believed to be present in cases of aphasia are not capable yet of positive demonstration. The disorder may exist in any of the typical forms, and yet no appreciable change be detected in any part of the cerebral substance or its blood-vessels. The following are the general results of *clinical* and *post-mortem* investigation:—(1.) In a large majority of cases of aphasia the peculiar inability of speech is associated with unilateral palsy, indicating disease of the left hemisphere of the cerebrum. (2.) In numerous cases, but not in all, there is disease of the third left frontal convolution of the cerebrum, or in the left anterior lobe, very near to this convolution. (3.) The whole of this convolution and the left anterior lobe of the brain may be wholly or partially destroyed, and yet no loss of speech has been observed. (4.) Aphasia may exist with apparent integrity of the left anterior lobe of the cerebrum, and indeed of the whole brain.

As a separate and distinct disease due to a specific lesion, *aphasia* cannot yet find a place in nosology. The phenomena are complex in the extreme; and the connecting link between the mental defect and loss of speech, with material change in the brain, is both clinically and anatomically still incomplete. Mental co-operation is defective in all the cases.

Prognosis.—Aphasia following typhoid fever has been the most

favourable in its result; and even with obvious brain lesion, speech may return after having been absent for years. Where the lesion has been believed to be the result of syphilis, cases of aphasia have also recovered. The prognosis in all cases must be a guarded one.

Treatment.—No definite or specific line of treatment can be given. Every case must be prescribed for on its own merits, and after a careful study of the probable origin and nature of the circumstances which have led to aphasia.

PARALYSIS DUE TO BLOOD-POISONING.

As a clear diagnosis of the various forms of paralysis referred to in the previous pages is specially of importance with regard to the line of treatment to be adopted in any particular case, it is only necessary to notice here that paralysis may be due to blood-poisoning. Several of these forms of paralysis have been already noticed—*e. g.*, paralysis from the use of the vetch known as the *lathyrus sativus* (vol. i., p. 860); also from lead-poisoning (vol. i., p. 841); and from alcohol (vol. i., p. 827). To these must be added paralysis from diphtheria (vol. i., p. 572); also paralysis from syphilis (vol. i., p. 743).

With reference to paralysis from poisons, the principle of treatment must be that by elimination; and on this subject the reader is referred to an able article by the late Dr. Easton, Professor of Materia Medica in the University of Glasgow, in the sixth volume of the *Glasgow Medical Journal*, p. 155, *et passim.*

ANÆSTHESIA.

LATIN EQ., *Anæsthesia;* FRENCH EQ., *Anesthésie;* GERMAN EQ., *Anæsthesie;* ITALIAN EQ., *Anestesia.*

Definition.—*The term anæsthesia implies a diminution or loss of function in a sensory nerve, from its nervous force being reduced or destroyed—paralysis of sensation.*

Pathology.—Sensibility admits of varying degrees, being different at different parts of the cutaneous surface, as proved by the experiments of Weber. His mode of experimenting may be adopted, as already noticed, as a practical means of diagnosis in paralysis of sensation.

Anæsthesia most commonly occurs as an immediate antecedent of motor palsy, or coincident with it, and also exists in various parts of the body independent of paralysis of motion. It varies in extent from a mere numbness of the parts to a complete loss of sensation. The cutaneous nerves are those most frequently affected, and from this cause the disease most usually attacks the integuments of a portion of the trunk, or of an arm, or a leg, or some portion of the extremities, and also the whole face or parts of the face.

The most important form in which insensibility comes under the notice of the practical physician is that known as FACIAL ANÆSTHESIA. It consists in a deficient or entire loss of sensibility in the parts supplied by the fifth pair of nerves.

Symptoms and Diagnosis of the Seat of Lesion.—(1.) The more the anæsthesia is confined to single filaments, the more peripheral is the seat of lesion. (2.) If the loss of sensation affects a portion of the facial surface, together with the corresponding cavity of the face, the disease may be presumed to involve the sensory fibres of the fifth pair before they separate, or one of the main divisions after its passage through its cranial foramen. (3.) When the entire sensific tract of the fifth nerve has lost its sensation, associated with derangements of the nutritive functions in the affected parts, the Gasserion ganglion, or the nerves in its immediate vicinity, may be the seat of the disease. (4.) If the fifth nerve is complicated with disturbed functions of adjoining cerebral nerves, it may be presumed that the lesion is situated at the base of the brain (ROMBERG).

The symptoms may develop themselves gradually, or may come on suddenly, and are not unfrequently preceded by neuralgia; and owing to the differences in the seat of lesion, what may seem to be a permanent symptom in many is absent or less marked in others. It is frequently complicated with facial palsy of the *portio dura* of the seventh nerve. In a well-marked case the symptoms may be generally stated to be loss of tactile sensibility of the parts supplied by the nerve—namely, the integuments of the cheek and side of the head, the eyelids, conjunctiva, tongue, Schneiderian membrane—accompanied by loss of taste on the side of the tongue which is affected, frequently by loss of smell and hearing, and by inflammation of the eye, terminating in ulceration of the cornea, and by no means uncommonly in total

disorganization of the globe. Paralysis and wasting of the deep muscles of mastication are also sometimes associated. The real nature of the affection may escape notice if the attention is directed solely to any one prominent symptom, such as ophthalmia. The disease makes its onset in two or three ways. It is often sudden, preceded by a slight perversion of sensibility, or by a tingling sensation, frequent attacks of headache, and pains in the occipital region and side of the face. Dimness of vision is so prominent a symptom in some cases that loss of sensibility may not at first attract attention. Of twenty-four cases, vision was affected in fifteen, hearing in nine, and smell in six (Dr. J. B. Cowan in *Glasgow Med. Journal*, No. II., July, 1853).

There are two important features in facial anæsthesia worthy of special notice—namely, 1st. That the parts do not waste as in muscular palsy; 2d. That though the parts are insensible to touch, they still remain sensible to changes of temperature, and to pain arising from inflammation in the nerve itself.

Causes.—The anæsthesia may result from disease—(1.) Of the cerebrum where the fifth nerve takes its origin; (2.) Of the nerve within the cranium; (3.) Of the nerve after it has emerged from the cranium; and according to the seat the symptoms vary.

The disease may be a consequence of some injury, such as the extraction of a tooth, as frequently happens to the submental branch, which conveys sensation to half the lower lip.

Dissections show that condensation, atrophy, softening, and the pressure of tumors are the morbid conditions out of which the anæsthesia springs. So varied are the sources whence the anæsthesia results, that its treatment can only be palliative, and directed towards mitigation of the symptoms. Spontaneous cures are said not to be unfrequent. The local applications, such as blisters, leeching, and cupping, are said to have been sometimes useful, combined with the administrations of purgatives.

NEURALGIA.

LATIN EQ., *Neuralgia;* FRENCH EQ., *Néuralgie;* GERMAN EQ., *Neuralgia;* ITALIAN EQ., *Neuralgia.*

Definition.—*Excruciating pain, which returns with renewed violence in a part after periods of temporary remission, and which is believed to be due to some unknown morbid state of*

the nerves of sensation, a symptom of a local lesion, or more commonly of a general affection.

Pathology.—All neuralgias are symptomatic either of an organic lesion, of which the neuralgic pain is a reflex or sympathetic expression, or the pain is due to a more or less grave organic lesion, involving, compressing, or otherwise irritating various branches of nerves. In some cases neuralgia is symptomatic of various cachexias—*e. g.*, of chlorosis, of lead-poisoning, of anæmia, of malaria, of rheumatism, of syphilis; or it is a reflex induction from an acute inflammation, as from a carious tooth, a necrosed bone, a tumor, or a plegmon. The form of the neuralgia from these several sources may vary, but *pain* of the characteristic kind defined in the definition is alike common to all. In most cases marked peripheral lesions are the starting-point of neuralgia, as in cases of decayed teeth, of necrosed bones, of tumors developed in the vicinity or in the substance of nerve-trunks, or of inflammation, including nerves within their area (TROUSSEAU).

The pain of neuralgia is distinct in character, and involves the minimum of organic change in the affected part, while the whole circumstances of the affection point to lowered vitality as the antecedent cause of the pain (ANSTIE). "The general bodily health is always at a low point when the attacks occur, and the nerves of the part are habitually in circumstances which must tend to lower their functional activity." Dr. Anstie gives circumstantial evidence of this in his own case, consisting of the passive flow of tears, the hair of the right eyebrow becoming decidedly grey at a point exactly opposite the *supra-orbital nerve* (the one affected). These he justly regards as so many indications of *defective nervous energy.* Pain under such circumstances is generally the direct consequence of a further depression of an already feeble vitality in the nerves (ANSTIE, *op. cit.*, p. 84).

The principal varieties of this affection are—(*a.*) *Facial neuralgia* or *tic douloureux;* (*b.*) *Brow ague* or *hemicrania;* (*c.*) *Sciatica;* (*d.*) *Intercostal neuralgia.*

Symptoms.—The symptoms are similar in kind, whichever nerve is affected, modified only by the position, connections, and distribution of the nerve.

The branches of the *trifacial* nerve may be attacked separately

or conjointly; most commonly, however, only one branch is affected, less frequently two, and the case must be severe in which the three branches, or the whole side of the face, is affected. Nevertheless, it sometimes so happens, extending even over the summit of the head, and over the temporal region, by the deep branch of the fifth pair, which emerges to the surface anterior to the external meatus. It is even also associated with a similar affection of the occipital branches at the same time.

The attack is sometimes sudden, but more generally it is preceded by a dull aching pain at the points where the nerve issues from the cranium, or becomes superficial. After this threatening symptom has lasted a few hours or a few days, the patient is seized with a violent darting or shooting pain in the course of the nerve, returning at intervals—phenomena which are characteristic of the disease. The paroxysm is short, lasting only a few seconds or a few minutes; but the pain is perhaps the most severe that the human frame is capable of suffering. Some patients have compared it to an electric shock of great intensity, others to the conflagration of gunpowder, and others to the intensity and violence of a fulminating powder. The late Dr. Pemberton was known to have stamped the bottom of his carriage out during the paroxysm; and Valleix mentions a physician who, suffering from neuralgia, was induced, by excessive agony, to make deep incisions into his face, and then to apply the actual cautery to the wound; but his pain not being mitigated by these methods, he several times attempted suicide. Even in mild cases the patient often, on the instant of attack, becomes fixed like a statue, fearing to move a muscle or a limb, lest he should aggravate the pain or reproduce the seizure. This is a condition common to many nervous affections attended by excruciating pain, such as *angina pectoris*.

In cases of ordinary intensity the effect is so completely limited to the nerve that the skin is not discoloured, while the organs immediately in connection with it are little affected—the eye, perhaps, being only watery, the nose hot, and the teeth aching. In severer cases, however, and where the disease affects the nerve generally, or the whole face and scalp, the condition of the patient is most lamentable. The mouth is spasmodically drawn, as in palsy, so that the saliva flows over the chin and neck, or

the teeth chatter by the clonic spasms which sometimes attend the disease. The saliva is increased in quantity and altered in quality; for in cases in which the patient is afraid to brush his teeth, lest the paroxysm should return, the whole of the teeth of the lower jaw become so incrusted with tartar as to form one solid mass, indicating at the same time a depraved state of the digestive organs. The eye and eyelid are likewise frequently convulsed, the conjunctiva injected, and the nose discharges a muciform matter. To touch even the hair of the head produces pain, and sometimes the affected nerve may be traced by a red line marking its course. The recurrence of the paroxysm is uncertain: in slight cases it may return only once in a few weeks, or in a few days; but in some severe cases it will return every quarter of an hour, every five minutes, or every minute, and even every few seconds. In a few cases the paroxysms occur periodically, and at stated intervals. In general, however, the times of recurrence are uncertain: sometimes the patient is attacked with great violence many times a day for many days or weeks together, so that the disease is almost continuous; at other times it intermits for a week, a month, six months, or a year. The disease is situated nearly as often on the right as on the left side of the face; and sometimes on both sides.

When the branches of the fifth cranial nerve are affected, the most painful points are at the exit of the ophthalmic, of the superior, and of the inferior maxillary branches. Next to those the frontal, and next the parietal, and lastly the occipital, although its origin is independent of that of the trigeminal; and whether the trigeminal was affected by itself, or the occipital nerve as well, Trousseau has always observed that "pressure made on the spinous processes of the first two cervical vertebræ always caused pain, and in a certain proportion of cases immediately brought on shooting pain in the diseased nerves. When the nerves of the brachial plexus are affected, pressure made over the spinous processes of the last cervical vertebræ gave pain;" so also in cases of intercostal, lumbar, or sciatic neuralgia, similar pressure over corresponding regions would also produce pain. Trousseau, therefore, makes the general statement, that "in neuralgia the spinous processes of the vertebræ are tender on pressure at a spot nearly corresponding to the point of exit of the nerve from the intervertebral foramen, and that the pain pretty frequently extends a

little farther up along the vertebral column." Thus neuralgia reveals itself by acute pain when pressure is made over the spinous processes which correspond to the origin or point of exit of the implicated nerves.

Cutaneous hyperæsthesia at the points of exit of the nerve-trunks is another peculiar characteristic of neuralgia. It is most marked in cases of intercostal, lumbar, and crural neuralgia. In such cases a slight scratch of the skin, or gently rubbing the skin with a blunt end of a pencil, will cause pain of a burning or pricking kind; and in many cases the track of the implicated nerve may be followed by the tip of the finger as far as its cutaneous distribution. More rarely the reverse of this condition supervenes—namely, *anæsthesia*. It is most apt to attend neuralgia apparently of a rheumatic origin, or which is due to a slight lesion of the cord. In such cases, when the *hyperæsthesia* has lasted a long time, it is followed by *anæsthesia*. In *herpes zoster* this is apt to occur; also in *sciatic neuralgia*.

Certain *superficial tender spots* are also characteristic of neuralgia. It is generally at the point of exit of nerves from an osseous foramen that pain is most particularly felt. Thus, in neuralgia of the fifth pair, it is over the *supra-orbital notch*, where the ophthalmic branch becomes superficial; over the *infra-orbital foramen*, which gives passage to the superior maxillary branch; and over the *mental foramen*, through which emerges the inferior maxillary division of the fifth pair. But when *supra-orbital neuralgia* is intense, the point over the nasal branch is also extremely tender on pressure over the point of exit of this small nerve; and pressure over the frontal eminence also causes acute pain; and another tender point is over the *zygomatic process* in front of the ear (Trousseau).

The particular form of cachexia has also a remarkable influence on the seat of neuralgia. In chlorosis, neuralgia is apt to affect several regions, but notably the *trifaminal nerves* and nerves of the *solar plexus*. In cases of anæmia from *uterine hæmorrhages* or *leucorrhœa*, the neuralgia is mainly *gastric* and *intestinal*. In malaria, the ophthalmic nerve is mostly implicated. In rheumatic cachexia it is generally the occipital and sciatic nerves; and neuralgias of rheumatic origin are generally multiple in their manifestation, and frequently alternate with articular pains (Trousseau).

The exceptional cases, where pain is relieved by pressure, show that the conditions causing the pain have their site to the central side of the place pressed upon. Such cases may be relieved by division or removal of a portion of the nerve-trunk at the part pressed upon.

The duration of the disease is uncertain. In some cases it terminates after a few paroxysms; in others it lasts from one to six months; and in some cases it becomes chronic, and embitters existence during the whole period of a long life. It seldom disappears suddenly, but oscillates with a decreasing intensity, the intervals gradually becoming lengthened, till at last the disease subsides.

Causes.—The remote causes of neuralgia have been already indicated. Extremes of heat or cold, or sudden changes from the one to the other, often stand in the relation of cause to this disease. It is often a result of impaired general health. Thus women, after profuse menorrhagia, or after childbirth, or persons recovering from fever or other severe disease, are apt to suffer from neuralgic affections. Persons who have attempted to poison themselves with arsenic suffer agonizing pains along the course of the nerves of the limbs during convalescence. Blows, or wounds, or the pressure of aneurismal or other tumors, sometimes seated in the nerve itself, are also causes of this affection.

Neuralgia is more common in men than in women; and in women it occurs rather more frequently before thirty than afterwards, especially in those whose menstruation is irregular either as to time or quantity. Among the poor and laborious classes neuralgic complaints are numerous; and, roughly speaking, they mainly present three varieties:—(1.) *Neuralgia of the head and face;* (2.) *Neuralgia intercostalis;* (3.) *Sciatica.* The great majority of the patients are anæmic, and in a fair sprinkling of cases the anæmia is obviously connected with malaria (ANSTIE, *op. cit.*, p. 86).

Diagnosis.—The disease to which neuralgia bears most resemblance is rheumatism, but it is distinguished from it by the transitory nature of the attack, and by the absence of all swelling. There are certain points of the face which, upon being pressed in the interval of the paroxysm, give pain, and so far furnish phenomena which may aid in a differential diagnosis. Other diagnostic features are of importance to be noticed, such

as, if pain exists—(1.) Where the nerve emerges from the bone, as at the supra-orbitary, infra-orbitary, and mental foramina, in trifacial neuralgia; (2.) Where the nerve passing through the muscles reaches the skin; (3.) Where the nerve terminates in the skin; (4.) Where the nerve becomes very superficial, as the peroneal nerves; and, lastly, (5.) Where the pain affects the spinous processes corresponding to the exit of the implicated nerves.

Treatment.—A practitioner has generally some mode of treatment which, during his practice, he considers specific in this disease. *Sarsaparilla*, the *sulphate of iron*, the *carbonate of iron*, *arsenic*, *mercury*, or the *sulphate of quinia*, have all been recommended with confidence. Bleeding, either local or general, has had its advocates, while its opponents affirm this operation to be always useless and sometimes injurious. There can be no question that the disease has often subsided under the use of all these various remedies; but the tendency in neuralgia to a spontaneous intermission is so great that it is doubtful whether in any case medicine can be said to have cured it. Opiates are unquestionably serviceable in mitigating the sufferings of the patient, and perhaps in influencing the disease, but not to the extent generally supposed. *Belladonna*, both internally and as a plaister, may sometimes relieve the pain. *Stramonium* and *opium* have a similar temporary effect. *Belladonna*, and perhaps *stramonium*, are better than opium as a habitual remedy, and they appear to have done good occasionally. *Chlorodyne* is also to be recommended, the composition of which has been determined by the Pharmaceutical Society, and a formula for which is given in vol. i., p. 502.

The remedies of most value are the diffusible stimulants, such as *sal volatile*, hot tea, quinine in a full dose, alcohol in small doses, blistering, ammoniacal fluid to the skin immediately over the painful nerves, and the endermic application of a fifth of a grain of morphia. These remedies act by increasing the supply of blood to the painful nerve, and, *pro tanto*, heightening its vital energy (ANSTIE, *op. cit.*, p. 84). The most speedy way of obtaining a temporary relief is certainly the application of a local stimulant, and more especially of some volatile agent, such as mustard, or, still better, chloroform diluted with *seven* parts of some simple liniment (ANSTIE). A rapidly acting blistering fluid is still more effective. But the more profoundly the general health has been

affected, and especially the greater the degree of anæmia, the more necessary is it to join with the use of stimulants (both local, such as above mentioned, and general, such as the *carbonate* and *muriate* of ammonia, taken in *five* and *ten* grain doses respectively) a treatment directed to improving the condition of the blood by "food tonics," such as cod-liver oil, arsenic, or steel, or a combination of some of them, joined with the use of local stimulation, by means of frictions with dilute chloroform, and the manipulations of the scientific "*shampooer*" (ANSTIE, *op. cit.*, p. 87). Dr. Radcliffe reports favourably of the *hypophosphite of soda*, and believes that the *phosphorus* of this salt acts directly as a food to the nervous tissue. The subcutaneous injection of small doses ($\frac{1}{6}$ to $\frac{1}{4}$ of a grain) of morphia in solution will give temporary relief, and is especially useful to those patients who are obliged to go through an ordinary day of labour (ANSTIE, *op. cit.*, p. 87).

When these or other general remedies have proved insufficient, recourse has been had to local remedies. The most efficient of these applications is the alkaloid *aconitina*, rubbed upon the pained part in the form of an ointment, in the proportion of one or two grains to one drachm of lard. Morphia similarly used, and blisters, have also often exercised a beneficial effect upon the disease. Holding the head over steam, and the warm bath, are equally or even more beneficial in cases of facial neuralgia. The belladonna plaister is also a favourite application. When the neuralgia is superficial, compresses steeped in a solution of atropia have a good effect. Trousseau recommends the following formula:—

℞. *Atropiæ sulphatis*, gr. v.; *Aquæ distillatæ*, ℥iii.; *solve*. Renew the compresses several times in the twenty-four hours. Continue them for at least an hour each time, and cover them with oilskin, to prevent evaporation.

When general and local applications are unsuccessful, the cause may be sought for in a diseased tooth or stump, and in a *very few* instances an exostosis of the stump has been discovered, removed, and the disease cured. Sometimes, however, even when the patient submits to have every tooth in his head drawn, no relief or benefit has resulted. The division of a nerve is sometimes had recourse to; but even this operation is very uncertain.

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